Mortara

www.mortara.com

REF 9516-177-50-ENG Rev F1

ELI 150c/250c

12-LEAD RESTING ELECTROCARDIOGRAPH

SERVICE MANUAL

Manufactured by Mortara Instrument, Inc., Milwaukee, Wisconsin U.S.A.

CE 0459

CAUTION: *Federal law restricts this device to sale by or on the order of a physician.*

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NOTICES

Manufacturer's Responsibility

Mortara Instrument, Inc. is responsible for the effects on safety and performance only if:

- Assembly operations, extensions, readjustments, modifications, or repairs are carried out only by persons authorized by Mortara Instrument, Inc.
- The device is used in accordance with the instructions for use.

Responsibility of the Customer

The user of this device is responsible for ensuring the implementation of a satisfactory maintenance schedule. Failure to do so may cause undue failure and possible health hazards.

Equipment Identification

Mortara Instrument, Inc. equipment is identified by a serial and reference number on the back of the device. Care should be taken so that these numbers are not defaced.

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WARRANTY INFORMATION

Your Mortara Warranty

MORTARA INSTRUMENT, INC. (hereafter referred to as "Mortara") warrants that components within Mortara products (hereafter referred to as "Product/s") will be free from defects in workmanship and materials for the number of years specified on documentation accompanying the product, or previously agreed to by the purchaser and Mortara, or if not otherwise noted, for a period of twenty-four (24) months from the date of shipment.

Consumable, disposable or single use products such as, but not limited to, PAPER or ELECTRODES are warranted to be free from defects in workmanship and materials for a period of 90 days from the date of shipment or the date of first use, whichever is sooner.

Reusable product such as, but not limited to, BATTERIES, BLOOD PRESSURE CUFFS, BLOOD PRESSURE HOSES, TRANSDUCER CABLES, Y-CABLES, PATIENT CABLES, LEAD WIRES, MAGNETIC STORAGE MEDIUMS, CARRY CASES or MOUNTS, are warranted to be free from defects in workmanship and materials for a period of 90 days. This warranty does not apply to damage to the Product/s caused by any or all of the following circumstances or conditions:

a) Freight damage;

b) Parts and/or accessories of the Product/s not obtained from or approved by Mortara;

c) Misapplication, misuse, abuse, and/or failure to follow the Product/s instruction sheets and/or information guides;

d) Accident; a disaster affecting the Product/s;

e) Alterations and/or modifications to the Product/s not authorized by Mortara;

f) Other events outside of Mortara's reasonable control or not arising under normal operating conditions.

THE REMEDY UNDER THIS WARRANTY IS LIMITED TO THE REPAIR OR REPLACEMENT WITHOUT CHARGE FOR LABOR OR MATERIALS, OR ANY PRODUCT/S FOUND UPON EXAMINATION BY MORTARA TO HAVE BEEN DEFECTIVE. This remedy shall be conditioned upon receipt of notice by Mortara of any alleged defects promptly after discovery thereof within the warranty period. Mortara's obligations under the foregoing warranty will further be conditioned upon the assumption by the purchaser of the Product/s (i) of all carrier charges with respect to any Product/s returned to Mortara's principal place or any other place as specifically designated by Mortara or an authorized distributor or representative of Mortara, and (ii) all risk of loss in transit. It is expressly agreed that the liability of Mortara is limited and that Mortara does not function as an insurer. A purchaser of a Product/s, by its acceptance and purchase thereof, acknowledges and agrees that Mortara is not liable for loss, harm, or damage due directly or indirectly to an occurrence or consequence therefrom relating to the Product/s. If Mortara should be found liable to anyone under any theory (except the expressed warranty set forth herein) for loss, harm, or damage, the liability of Mortara shall be limited to the lesser of the actual loss, harm, or damage, or the original purchase price of the Product/s when sold.

EXCEPT AS SET FORTH HEREIN WITH RESPECT TO REIMBURSEMENT OF LABOR CHARGES, A PURCHASER'S SOLE EXCLUSIVE REMEDY AGAINST MORTARA FOR CLAIMS RELATING TO THE PRODUCT/S FOR ANY AND ALL LOSSES AND DAMAGES RESULTING FROM ANY CAUSE SHALL BE THE REPAIR OR REPLACEMENT OF DEFECTIVE PRODUCT/S TO THE EXTENT THAT THE DEFECT IS NOTICED AND MORTARA IS NOTIFIED WITHIN THE WARRANTY PERIOD. IN NO EVENT, INCLUDING THE CLAIM FOR NEGLIGENCE, SHALL MORTARA BE LIABLE FOR INCIDENTAL, SPECIAL, OR CONSEQUENTIAL DAMAGES, OR FOR ANY OTHER LOSS, DAMAGE, OR EXPENSE OF ANY KIND, INCLUDING LOSS OF PROFITS, WHETHER UNDER TORT, NEGLIGENCE OR STRICT LIABILITY THEORIES OF LAW, OR OTHERWISE. THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO THE IMPLIED WARRANTY OF MERCHANTABILITY AND THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

USER SAFETY INFORMATION

Warning: Means there is the possibility of personal injury to you or others.

Caution: Means there is the possibility of damage to the device.

Note: Provides information to further assist in the use of the device.

Warning(s)

- This manual gives important information about the use and safety of this device. Deviating from operating procedures, misuse or misapplication of the device, or ignoring specifications and recommendations could result in increased risk of harm to users, patients and bystanders, or damage to the device.
- Device captures and presents data reflecting a patient's physiological condition that when reviewed by a trained physician or clinician can be useful in determining a diagnosis; however, the data should not be used as a sole means for determining a patient's diagnosis.
- Users are expected to be licensed clinical professionals knowledgeable about medical procedures and patient care, and adequately trained in the use of this device. Before attempting to use this device for clinical applications, the operator must read and understand the contents of the user manual and other accompanying documents. Inadequate knowledge or training could result in increased risk of harm to users, patients and bystanders, or damage to the device. Contact Mortara service for additional training options.
- To ensure that electrical safety is maintained during operation from AC (~) power, the device must be plugged into a hospital-grade outlet.
- To maintain designed operator and patient safety, peripheral equipment and accessories used that can come in direct patient contact must be in compliance with UL 60601-1, IEC 60601-1, and IEC 60601-2-25. Only use parts and accessories supplied with the device and available through Mortara Instrument, Inc.
- Patient cables intended for use with the device include series resistance (9 Kohm minimum) in each lead for defibrillation protection. Patient cables should be checked for cracks or breakage prior to use.
- Conductive parts of the patient cable, electrodes, and associated connections of type CF applied parts, including the neutral conductor of the patient cable and electrodes, should not come into contact with other conductive parts including earth ground.
- ECG electrodes could cause skin irritation; patients should be examined for signs of irritation or inflammation.
- To avoid the possibility of serious injury or death during patient defibrillation, do not come into contact with device or patient cables. Additionally, proper placement of defibrillator paddles in relation to the electrodes is required to minimize harm to the patient.

- This device was designed to use the electrodes specified in this manual. Proper clinical procedure must be employed to prep the electrode sites and to monitor the patient for excessive skin irritation, inflammation, or other adverse reactions. Electrodes are intended for short-term use and should be removed from the patient promptly following testing.

- To avoid potential for spread of disease or infection, single-use disposable components (e.g., electrodes) must not be reused. To maintain safety and effectiveness, electrodes must not be used beyond their expiration date.

- To ensure the safety of both the patient and the device, 1.5 meters (5') of open area should surround the patient.

- A possible explosion hazard exists. Do not use the device in the presence of a flammable anesthetic mixture.

- Where the integrity of external protective earth conductor arrangement is in doubt, the device shall be operated from its internal electrical power source.

- All signal input and output (I/O) connectors are intended for connection of only those devices complying with IEC 60601-1, or other IEC standards (e.g., IEC 60950) as appropriate to the device. Connecting additional devices to the device may increase chassis and/or patient leakage currents. To maintain operator and patient safety, consideration should be given to the requirements of IEC 60601-1-1, and leakage currents should be measured to confirm no electric shock hazard exists.

- To improve immunity to potential interfering electromagnetic signals, shielded cabling is recommended when connecting the device to a network.

- To maintain operator and patient safety, equipment connected to the same network as the device must meet the requirements of IEC 60950 or IEC 60601-1.

- To prevent electric shock due to unequal ground potentials that may exist between points of a distributed network system or fault conditions in external network connected equipment, network cable shielding (where used) must be connected to protective earth ground appropriate to the area where the device is used.

- The device has not been designed for use with high-frequency (HF) surgical equipment and does not provide a protective means against hazards to the patient.

- The quality of the signal produced by the device may be adversely affected by the use of other medical equipment, including but not limited to defibrillators and ultrasound machines.

- For proper operation and the safety of users or patients and bystanders, equipment and accessories must be connected only as described in this manual. Do not connect a telephone line cable to the LAN connector.

- Some Mortara electrocardiographs can be equipped with a GSM/GPRS (cellular modem) or wireless LAN (WLAN) module for transmitting ECG records. Device labeling and the presence of an antenna port will indicate if your device is equipped with such a module. If so equipped, the following notices apply:

    - The GSM/GPRS module operates in allocated frequency bands depending on the model. Identification of the installed GSM/GPRS module can be found on a label on the bottom of the device.
        - MultiTech Systems, Inc. Model MTSMC-G-F4 (Quad Band): 850/900/1800/1900 MHz, user selectable

    - The WLAN identification can be found on a label on the bottom of the device.
        - Quatech, Inc. Model WLNG-AN-DP101: 2400 MHz
          (model subject to change without notice)

- Use of the GSM/GPRS or WLAN module may interfere with other equipment operating in the vicinity. Check with local authorities or spectrum management officials in your facility to determine if restrictions apply to the use of this feature in your area.

- Do not transmit via the GSM/GPRS or WLAN module with a missing or damaged antenna. Replace a damaged antenna immediately.

- Use only the antenna supplied for use with this device. Unauthorized antennas, modifications, or attachments could damage the GSM module and may contravene local RF emission regulations or invalidate type approval.

- To ensure compliance with current regulations limiting both maximum RF output power and human exposure to radio frequency radiation, a separation distance of at least 20 cm must be maintained between the device's antenna and the head and body of the user and any nearby persons at all times. To help prevent degradation of RF signal and to avoid excess RF energy absorption, do not touch the antenna during data transmission.

- The GSM/GPRS and WLAN modules comply with applicable RF safety standards including standards and recommendations for the protection of public exposure to RF electromagnetic energy that have been established by governmental bodies and other qualified organizations, such as the following:
    - Federal Communications Commission (FCC)
    - Directives of the European Community
    - Directorate General V in Matters of Radio Frequency Electromagnetic Energy

Caution(s)

- To prevent possible damage to the keyboard, do not use sharp or hard objects to depress keys, only use fingertips.

- Do not attempt to clean the device or patient cables by submersing into a liquid, autoclaving, or steam cleaning as this may damage equipment or reduce its usable life. Wipe the exterior surfaces with a warm water and mild detergent solution and then dry with a clean cloth. Use of unspecified cleaning/disinfecting agents, failure to follow recommended procedures, or contact with unspecified materials could result in increased risk of harm to users, patients and bystanders, or damage to the device.

- No user-serviceable parts inside. Screw removal by qualified service personnel only. Damaged or suspected inoperative equipment must be immediately removed from use and must be checked/repaired by qualified service personnel prior to continued use.

- The rechargeable internal battery is a sealed lead-acid type and it is totally maintenance free. If the battery appears to become defective, refer to Mortara Instrument Service Department.

- Do not pull or stretch patient cables as this could result in mechanical and/or electrical failures. Patient cables should be stored after forming them into a loose loop.

- No calibration or special equipments are needed for the proper operation or maintenance of the device.

- When necessary, dispose of the device, its components and accessories (e.g., batteries, cables, electrodes), and/or packing materials in accordance with local regulations.

- Use only No. 26 AWG or larger telecommunication line cord.

Note(s)

- Patient movements may generate excessive noise that may affect the quality of the ECG traces and the proper analysis performed by the device.
- Proper patient preparation is important to proper application of ECG electrodes and operation of the device.
- The algorithm detecting electrode misplacements is based on normal physiology and ECG lead order, and tries to identify the most likely switch; however, it is advisable to check the other electrode positions in the same group (limb or chest).
- There is no known safety hazard if other equipment, such as pacemakers or other stimulators, is used simultaneously with the device; however, disturbance to the signal may occur.
- If electrode is not properly connected to the patient, or one or more of the patient cable lead wires is damaged, display will indicate a lead fault for the lead(s) where the condition is present and if the signal is being printed, the respective lead(s) will print out as a square wave.
- As defined by IEC 60601-1 and IEC 60601-2-25, the device is classified as follows:
  - Class I equipment or internally powered.
  - Type CF defibrillation-proof applied parts.
  - Ordinary equipment.
  - Equipment not suitable for use in the presence of a flammable anesthetic mixture.
  - Continuous operation.

  NOTE: *From a safety perspective, per IEC 60601-1 and derivative standards/norms, this device is declared to be "Class I" and uses a three-prong inlet to ensure an earth connection is made along with mains. The ground terminal on the mains inlet is the only protective earth point in the device. Exposed metal accessible during normal operation is double insulated from mains. Internal connections to earth ground are functional earth.*
- This device is intended to be used in a hospital or doctor's office setting, and should be used and stored according to the environmental conditions specified below:

Operating temperature:	+10° to +40°C (+50° to +104°F)
Operating humidity:	10% to 95% RH, non-condensing
Storage temperature:	-40° to +70°C (-40° to +158°F)
Storage humidity:	10% to 95% RH, non-condensing
Atmospheric pressure:	500 hPa to 1060 hPa

- WAM™ (wireless acquisition module) must be paired to electrocardiograph before operation.
- Device must be configured at the factory for use with the WAM.
- After operating the device using battery power, always reconnect the power cord. This ensures that the batteries will be automatically recharged for the next time you use the device.

- The device is UL classified:

WITH RESPECT TO ELECTRIC SHOCK, FIRE AND MECHANICAL HAZARDS ONLY IN ACCORDANCE WITH UL60601-1, IEC60601-1, CAN/CSA C22.2 No. 601.1, IEC 60601-1-1, CAN/CSA C22.2 No. 60601-1-1-02, IEC60601-2-25 AND CAN/CSA C22.2 No. 601.2.25-94.

- The device is a member of the ELI 1xx or ELI 2xx Series 2 electrocardiograph family.

Wireless Data Transmission

- Some Mortara electrocardiographs can be equipped with an optional wireless data transmission module (WLAN or GSM/GPRS mobile). Both these technologies use radios to transmit data to a Mortara receiving application. Due to the nature of radio transmissions, it's possible that, due to the characteristics of the environment where the device is located, some other RF sources may interfere with the transmission generated by the device. Mortara Instrument has tested the coexistence of the device with other devices that can interfere such as devices using WLAN, Bluetooth radio, and/or cell phones. Although the current technology allows a very successful rate of transmission, it's possible that in some rare occurrences, the system may not perform at its best resulting in a "failed transmission." When this occurs, patient data will not be erased from the device nor stored in the receiving application, ensuring that partial or corrupted data are not made available to the receiving station. If the failure mode persists the user should move to a position where the RF signals may propagate better and allow successful transmissions.

WLAN Option

- Wireless options transmit in the 2.4 GHz or 5ghz range. Other nearby wireless devices may cause interference. If possible, move or turn off other devices to minimize potential interference.

- The Wireless LAN module used is compliant with the IEEE 802.11 a, b, g and n standards.

- Access Points used should respect IEEE 802.11 standards as well as local Radio Frequency regulations. The device will scan the available channels and connect to the Access Point on the channel where the SSID that is configured on the device is available.

- The following table shows the radio channels allocated in different geographic areas in the world. For bands 802.11b and g, only channels 1, 6, 11 and 14 (Japan only) are non-overlapping; for band 802-11a, channels shown represent non-overlapping channel numbers.

Band	Typical Power	Region	Frequency Range (GHz)	No. of channels	Channel numbers
802.11b	15 dBm / 32 mW	USA/Canada	2.401 - 2.473	11	1 – 11
		Europe	2.401 - 2.483	13	1 – 13
		Japan	2.401 - 2.495	14	1 – 14
802.11g	13 dBm / 18 mW	USA/Canada	2.401 - 2.473	11	1 – 11
		Europe	2.401 - 2.483	13	1 – 13
		Japan	2.401 - 2.483	13	1 – 13
802.11a	17 dBm / 50 mW	USA/Canada	5.15 - 5.35, 5.725 - 5.825	13	36,40,44,48,52,56,60,64,149, 153,157,161,165
		Europe	5.15 - 5.35, 5.47 - 5.725	19	36,40,44,48,52,56,60,64,100, 104,108,112,116,120,124, 128,132,136,140
		Japan	4.91 – 4.99, 5.15 - 5.35, 5.47 - 5.725	23	36,40,44,48,52,56,60,64,100, 104,108,112,116,120,124, 128,132,136,140,184188, 192,196
		China	5.725 - 5.825	5	149,153,157,161,165

- The following table lists the frequency allocated for each channel used by the WLAN option.

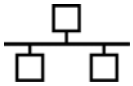
Channel	Center Frequency	Frequency Spread
1	2412 MHz	2399.5 MHz - 2424.5 MHz
2	2417 MHz	2404.5 MHz - 2429.5 MHz
3	2422 MHz	2409.5 MHz - 2434.5 MHz
4	2427 MHz	2414.5 MHz - 2439.5 MHz
5	2432 MHz	2419.5 MHz - 2444.5 MHz
6	2437 MHz	2424.5 MHz - 2449.5 MHz
7	2442 MHz	2429.5 MHz - 2454.5 MHz
8	2447 MHz	2434.5 MHz - 2459.5 MHz
9	2452 MHz	2439.5 MHz - 2464.5 MHz
10	2457 MHz	2444.5 MHz - 2469.5 MHz
11	2462 MHz	2449.5 MHz - 2474.5 MHz
12	2467 MHz	2454.5 MHz - 2479.5 MHz
13	2472 MHz	2459.5 MHz - 2484.5 MHz
14	2484 MHz	2471.5 MHz – 2496.5 MHz

- In order to achieve the best transmission rate, it is necessary that the facility where the device is operated can provide good area coverage. Please consult the IT personnel of the facility to verify the proper WLAN availability in the area where the device will be used.

- RF wave propagation may be blocked or reduced by the environment where the device is used. Most common areas where this may occur are: shielded rooms, elevators, underground rooms. In all the above situations, it is recommended to move the device to a proper location and verify with the IT personnel of the facility the areas where the WLAN signals are available.

EQUIPMENT SYMBOLS AND MARKINGS

Symbol Delineation

	Attention, consult accompanying documents
	Alternating current
	Protective earth
	Telephone line (modem)
	Network (LAN)
	Defibrillator-proof type CF applied part
	USB port
	Input
	ON/OFF (power)
	Stop (of action)
	Shift key (to enter upper case text)
	Enter key (accept data/return)
	Initiate printing of 12-lead ECG

RHY	Initiate printing of continuous rhythm strip
SYNC	Transmit, receive and time sync operation depending upon configuration settings
	Do not dispose as unsorted municipal waste. Per European Union Directive 2002/96, requires separate handling for waste disposal according to national requirements
	Antenna
CE 0459	Indicates compliance to applicable European Union directives

ELECTROMAGNETIC COMPATIBILITY (EMC)

Electromagnetic compatibility with surrounding devices should be assessed when using the device.

An electronic device can either generate or receive electromagnetic interference. Testing for electromagnetic compatibility (EMC) has been performed on the device according to the international standard for EMC for medical devices (IEC 60601-1-2). This IEC standard has been adopted in Europe as the European Norm (EN 60601-1-2).

The device should not be used adjacent to, or stacked on top of other equipment. If the device must be used adjacent to or stacked on top of other equipment, verify that the device operates in an acceptable manner in the configuration in which it will be used.

Fixed, portable, and mobile radio frequency communications equipment can affect the performance of medical equipment. See the appropriate table for recommended separation distances between the radio equipment and the device.

The use of accessories, transducers, and cables other than those specified by Mortara Instrument may result in increased emissions or decreased immunity of the equipment.

Guidance and Manufacturer's Declaration: Electromagnetic Emissions

The equipment is intended for use in the electromagnetic environment specified in the table below. The customer or the user of the equipment should ensure that it is used in such an environment.

Emissions Test	Compliance	Electromagnetic Environment: Guidance
RF Emissions CISPR 11	Group 1	The equipment uses RF energy only for its internal function. Therefore, its RF emissions are very low and not likely to cause any interference in nearby electronic equipment.
RF Emissions CISPR 11	Class A	The equipment is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic Emissions IEC 61000-3-2	Complies	
Voltage Fluctuations/ Flicker Emissions IEC 61000-3-3	Complies	

Guidance and Manufacturer's Declaration: Electromagnetic Immunity

The equipment is intended for use in the electromagnetic environment specified in the table below. The customer or the user of the equipment should ensure that it is used in such an environment.

Emissions Test	Compliance	Compliance Level	Electromagnetic Environment: Guidance
Electrostatic discharge (ESD) IEC 61000-4-2	+/- 6 kV contact +/- 8 kV air	+/- 6 kV contact +/- 8 kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	+/- 2 kV for power supply lines +/- 1 kV for input/output lines	+/- 2 kV for power supply lines +/- 1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	+/- 1 kV differential mode +/- 2 kV common mode	+/- 1 kV differential mode +/- 2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions, and voltage variations on power supply input lines IEC 61000-4-11	<5% UT (>95% dip in UT) for 0.5 cycle 40% UT (60% dip in UT) for 5 cycles	<5% UT (>95% dip in UT) for 0.5 cycle 40% UT (60% dip in UT) for 5 cycles	Mains power quality should be that of a typical commercial or hospital environment.
Power frequency (50/60 Hz) magnetic field	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.

NOTE: *UT is the AC Mains voltage prior to application of the test level.*

Guidance and Manufacturer's Declaration: Electromagnetic Immunity

The equipment is intended for use in the electromagnetic environment specified in the table below. The customer or the user of the equipment should ensure that it is used in such an environment.

<table>
<tr><th>Emissions Test</th><th>IEC 60601 Test Level</th><th>Compliance Level</th><th>Electromagnetic Environment: Guidance</th></tr>
<tr><td>Conducted RF
IEC 61000-4-6</td><td>3 Vrms
150 kHz to
80 MHz</td><td>3 Vrms
150 kHz to
80 MHz</td><td rowspan="2">Portable and mobile RF communications equipment should be used no closer to any part of the equipment, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.

Recommended separation distance

$d = \left[\frac{3.5}{3Vrms}\right]\sqrt{P}$

$d = \left[\frac{3.5}{3V/m}\right]\sqrt{P}$ 80 MHz to 800 MHz

$d = \left[\frac{7}{3V/m}\right]\sqrt{P}$ 800 MHz to 2.5 GHz

Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).

Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey[a], should be less than the compliance level in each frequency range[b].

Interference may occur in the vicinity of equipment marked with the following symbol:

 </td></tr>
<tr><td>Radiated RF
IEC 61000-4-3</td><td>3 V/m
80 MHz to
2.5 GHz</td><td>3 V/m
80 MHz to
2.5 GHz</td></tr>
</table>

a. Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radios, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the equipment is used exceeds the applicable RF compliance level above, the equipment should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the equipment.

b. Over the frequency range 150 kHz to 80 MHz, field strengths should be less than [3] V/m.

Recommended Separation Distances Between Portable and Mobile RF Communications Equipment and the Equipment

The equipment is intended for use in the electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the equipment can help to prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the equipment as recommended in the table below, according to the maximum output power of the communications equipment.

Rated Maximum Output Power of Transmitter W	Separation Distance According to Frequency of Transmitter (m)	
	150 KHz to 800 MHz	800 MHz to 2.5 GHz
	$d = 1.2\sqrt{P}$	$d = 2.3\sqrt{P}$
0.01	0.1 m	0.2 m
0.1	0.4 m	0.7 m
1	1.2 m	2.3 m
10	4.0 m	7.0 m
100	12.0 m	23.0 m

For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1: *At 800 MHz, the separation distance for the higher frequency range applies.*

NOTE 2: *These guidelines may not apply in all situations. Electromagnetic propagation is affected by the absorption and reflection from structures, objects, and people.*

Preventive Maintenance

Preventive maintenance is recommended to be performed on the ELI150c/250c once every 12 months.

Warning: Preventive maintenance is to be performed by Mortara authorized service personnel only.

2.0 Maintenance Procedure

2.1 Turn unit on and print the device configuration per section 3 of this manual. Attach a copy to the Preventive Maintenance Report.

2.2 Remove the unit cover per section 4 of this manual.

2.3 Perform a visual inspection of the following items:

2.3.1 Enclosure/Housing – Look for damage or cracks in the external housing or enclosure that could possibly expose the device to the introduction of foreign objects or fluids. Attention should also be paid to areas that could expose an operator or patient to internal circuitry of the device.

2.3.2 Contamination – Look for any contamination that may have occurred over time that could not be seen with the housing in place.

- Fluid damage (perhaps caused during device cleaning)
- Debris on or behind display shield
- Battery leakage (lithium and main battery)

2.3.3 Internal Cabling – Look for cracked, pinched or partially disconnected cable connections.

2.3.4 Fuse Ratings – Verify PCB mounted fuses (items 23 and 24) the meet the specifications defined in the item description listing.

2.3.5 Markings and Labeling – Verify all labels and device markings are clearly visible and legible to the device user and have not been worn off or rendered unreadable through the use of harsh cleaning agents.

2.3.6 Integrity of Mechanical Parts – Verify the following items are properly secured to the device and have not become loose or damaged through usage over time.

- AC Inlet
- Patient Input Connector
- Communication ports and antenna
- Writer mechanics/latching mechanism

2.4 Power Testing

* Based upon customer usage and age of battery, replace as needed.

2.4.1 Ensure battery is fully charged before performing these tests, voltage and current limits are based on a fully charged battery.

2.4.2 Ensure there is no power connected to the UUT AC inlet.

2.4.3 Remove upper housing and writer assembly. Disconnect battery by pulling battery cable off of the red terminal.

2.4.4 **Note battery age** (if possible)
This information can be found on the white “date code” sticker located on the battery (use the earliest date that is not crossed out).

2.4.5 **Battery (open circuit)**
Measure battery voltage using a voltage meter; verify the meter reads greater than 12.5vdc.

2.4.6 **Battery (load)**
Measure the battery voltage using a volt meter and a power resistor load (10ohm, 20watt) in parallel with the battery. After approximately 5 seconds, verify the meter reads greater than 11.7vdc.

2.4.7 **Off current**
Connect a current meter in line with battery. With the UUT power off, verify the current meter reads less than 100 micro amps.

2.4.8 **On current**
Turn on the unit and verify the current meter reads less than 250 milli amps.

2.4.9 **AC charging current**
Apply AC power to the unit and verify that the current draw from the battery reverses polarity and the value starts decreasing as time increases.

2.4.10 **Battery charger output voltage**
Disconnect the current meter and measure the battery charger output voltage between the red disconnected battery cable and the negative terminal on the battery. It should read between 13.0vdc and 14.0vdc.

2.5 Verify all power cables are reconnected properly

2.6 Reassemble unit in reverse order of disassembly

2.7 Functional Testing

2.7.1 **AC LED/Display**
Connect AC power cord to the unit and verify that the green AC LED (located to the left of the display) illuminates continuous.
NOTE: The battery indicator will be clear when charging and will illuminate white when fully charged.
Verify text on display is clear and legible and there are no flickering or missing lines/pixels.

2.7.2 **Writer**
Open and close the writer door to verify smooth operation. Verify that the door unlatches without sticking and that it latches completely. From the main screen, simultaneously press shift+alt+RHY. Verify that a test page is printed and the writer stops on the cue mark. The perforation of the paper should line up with the tear edge on the writer. Assure there are no gaps in the printing and the print darkness is uniform across the entire page. Verify the writer gears do not skip and paper is tracking properly (you may need to print multiple pages to observe this).

2.7.3 **ECG & Keyboard Matrix**
Connect an ECG simulator to the AM12 or WAM patient interface. Set the simulator to a known heart rate and amplitude; preferably to a setting that you have a "known good" printout for comparison. Press the ECG key to capture an ECG. Verify there is an audible beep with each key press. Enter Last name "PARCFL8" (Note: "PARCFL8" ensures the keyboard matrix is fully tested), then press F6 (Done). Verify that 12 ECG traces print correctly and assess the printout quality. Ensure uniform darkness across entire printout.

2.7.4 **ECG Noise Test**
Connect a Shorting Block (TF-0063) and adapter or equivalent to the AM12 or WAM patient interface. Set the ECG gain on the unit to 20mm/mV. Print a rhythm strip (approx. 1 page). Verify that no channels have more than 0.5mm of noise.

2.7.5 **Communication options**
Verify successful transmission of all applicable communication options by transmitting the ECG record stored in step 2.7.3 to a compatible receiving device:

- Modem
- LAN
- WLAN
- GSM/GPRS
- USB
- USBD

2.8 Clean unit per the instructions provided on the following page of this section of the service manual.

2.9 Safety Testing

The following safety tests should be performed in accordance with all local regulatory requirements:

- Earth Leakage
- Enclosure Leakage
- Patient Leakage
- Patient Auxiliary Current

Device Cleaning & Disinfecting

Warning:

- Use of non-recommended cleaning agents or practices could cause damage to the device or possible compromising of the electrical isolation of the device.
- Makes sure all cables and accessories are disconnected from the device prior to performing cleaning process.
- Do not immerse the device in liquid.
- Do not use organic solvents, ammonia-based solutions, or abrasive cleaning agents that may damage equipment surfaces.
- Do not use excessive amounts of liquid during cleaning or disinfecting of the device, as these fluids could enter the device housing and cause damage to the device.

Recommended Supplies:

- Clean lint free cloth
- Mild detergent
- Luke warm water
- 10% Household bleach and water solution (Sodium Hypochlorite solution consisting of a minimum 1:500 dilution and maximum of 1:10 dilution for disinfecting use only)

Device Cleaning:

Disconnect the AC power cord from the device. Clean the exterior surface of the device with a damp (not wet), soft, lint-free cloth using a solution of mild detergent diluted in luke warm water. After cleaning, thoroughly dry off the device with a clean, soft cloth or paper towel.

Device Disinfecting:

Clean the device per the instructions defined above, then wipe the exterior of the device with a damp (not wet), soft, lint-free cloth using a solution of 10% bleach and water. Allow the device to air dry after disinfecting before returning to use.

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ELI 150/250c Preventive Maintenance Report

Unit Serial #: _____

- □ Print device configuration (attach to this report)
- □ Remove the units upper housing
- □ Perform Visual Inspection
  - □ Enclosure/Housing
  - □ Contamination
  - □ Cabling
  - □ Fuse Ratings
  - □ Markings and Labeling
  - □ Integrity of Mechanically Parts
- □ Power Testing
  - □ Note Battery Age (If Possible) _____/_____ (week/year)
  - □ Battery (Open Circuit) Voltage _____ VDC
  - □ Battery (with Load) Voltage _____ VDC
  - □ Off Current _____ uA
  - □ On Current _____ A
  - □ Battery Charger Output Voltage _____ VDC

* Based upon customer usage and age of main battery, replace as needed.

- □ Verify all power cables are properly reconnected and reassemble unit
- □ Functional testing
  - □ AC LED/Display Functionality
  - □ Writer Test
  - □ ECG & Keyboard Matrix Testing
  - □ ECG Noise Test
  - □ Communication Options
- □ Device Cleaning
- □ Safety Testing PASS / FAIL (circle)
  - □ Earth Leakage
  - □ Enclosure Leakage
  - □ Patient Leakage
  - □ Patient Auxiliary Current

Technician or Field Service Engineer: _____ Date: _____/_____/_____

Setting Technician Password

1. From real-time ECG view, select **F6 (More)** followed by **F5 (Set Time/Date)**.
2. While holding down ⬆ **(SHIFT)**, depress **ALT** and **P** simultaneously.
3. If required, enter password. This will automatically advance you to the set passwords display.

   ***NOTE**: The factory default password is "admin" (lowercase, no quotation marks); it is suggested that the password be changed after installation of the unit.*

4. Enter a technician password followed by a second entry to confirm.

   ***NOTE:** Password is case sensitive and alphanumeric.*

5. From this display, select **F6 (Exit)** to return to real-time ECG view.

Configuration Menus

The configuration pages define all operational conditions that do not change on a daily or patient-to-patient basis. Once you set these default conditions, you will rarely need to use the configuration screens again. To access the configuration menus:

1. From real-time ECG view, select **F6 (More)** followed by **F5 (Set Time/Date)**.
2. While holding down ⬆ **(SHIFT)**, depress **ALT** and **C** simultaneously.
3. If required, enter password. The first configuration screen will appear. Notice the page indicator in the upper right-hand corner.

To navigate the configuration menus:

- Use **F4 (Page)** to toggle through the configuration pages.
- Use **F1 (▲)** and **F2 (▼)** to move back and forth through each configuration option.
- Use **F3 (►)** to toggle through pre-programmed available settings per configuration field.
- Use **F6 (Exit)** to return to real-time ECG view. Any changes you have made will be saved.
- Use **BKSP** to erase entry errors.

To print the device's configuration settings, select **F6 (More)** from real-time ECG view. Select **F6 (More)** again followed by **F1 (Print Configuration)**. The configuration printout captures every configuration setting: the software version, the cart number of the device, and the date and time that the configuration printout occurred.

Summary of Configuration Menus

Configuration Parameter	Definition
Software Version	Displays software version on printout and display
Cart Number	Numeric field 0 to 65535
Site Number	Numeric field 0 to 4095
Site Name	Alphanumerical field (30 digits)
Telephone Number	Alphanumerical field (45 digits)
Language	Available software languages
Volume	Numerical field 0 to 8
Battery Timeout	10 min, 30 min, 60 min
Flash Size	Normal or expanded (optional)
ID Format	Standard, Short, Long, Custom
Auto-Fill ID	YES/NO
AC Filter	50 Hz, 60 Hz, None
Paper Speed	25 or 50 mm/sec
Filter	Frequency response for printouts: 40 Hz, 150 Hz, 300 Hz
Height/Weight Units	lb/in or kg/cm
Date Format	US (mm/dd/yyyy) or European (dd.mm.yyyy)
Interpretation	YES/NO
Reasons	YES/NO
Append	Unconfirmed Report, Reviewed by
# of Copies	0 – 9
Copies with Interp.	YES/NO
# ECGs Retrieved	0 – 7
Delete Rule	Post Plot, Post Transmit, Post Plot/Xmt
Storage Sensitivity	Normal or High
Auto-Save ECG	YES/NO
Auto-Print ECG	YES/NO
Cap Lock	YES/NO
Use A4 paper (ELI 250c only)	YES/NO
Rhythm Format	3 or 6 channel (ELI 150c); 3, 6, or 12 channel (ELI 250c)
3 Rhythm Lead 1	V1-V6, I, II, III, aVR, aVL, aVF
3 Rhythm Lead 2	V1-V6, I, II, III, aVR, aVL, aVF
3 Rhythm Lead 3	V1-V6, I, II, III, aVR, aVL, aVF
6 Rhythm Lead 1	V1-V6, I, II, III, aVR, aVL, aVF

Summary of Configuration Menus (continued)

Configuration Parameter	Definition
6 Rhythm Lead 2	V1-V6, I, II, III, aVR, aVL, aVF
6 Rhythm Lead 3	V1-V6, I, II, III, aVR, aVL, aVF
6 Rhythm Lead 4	V1-V6, I, II, III, aVR, aVL, aVF
6 Rhythm Lead 5	V1-V6, I, II, III, aVR, aVL, aVF
6 Rhythm Lead 6	V1-V6, I, II, III, aVR, aVL, aVF
Plot Format	3, 3+1, 3+3, 6 channel; Cabrera or standard (ELI 150c) 3+1, 3+3, 6, 6+6, 12 channel; Cabrera or standard (ELI 250c)
3+1 Rhythm Lead	V1-V6, I, II, III, aVR, aVL, aVF
3+3 Rhythm Lead 1	V1-V6, I, II, III, aVR, aVL, aVF
3+3 Rhythm Lead 2	V1-V6, I, II, III, aVR, aVL, aVF
3+3 Rhythm Lead 3	V1-V6, I, II, III, aVR, aVL, aVF
Bar Code Scanner	YES/NO
Avg RR	YES/NO
QTcB	YES/NO
QTcF	YES/NO
ECG Capture	Last 10 or Best 10
Band Mode (GSM/GPRS only) (ELI 150c only)	850/1900MHz (US) or 900/1800MHz(EU)
Sync Media	None, Modem, LAN, WLAN, GSM/GPRS (GSM/GPRS option applies to ELI 150c only)
DHCP (active for LAN or WLAN)	YES/NO
IP Address (active for LAN or WLAN)	XXX.XXX.XXX.XXX
Def Gateway (active for LAN or WLAN)	XXX.XXX.XXX.XXX
Sub Net Mask (active for LAN or WLAN)	XXX.XXX.XXX.XXX
Host IP (active for LAN or WLAN)	XXX.XXX.XXX.XXX
Port Number (active for LAN or WLAN)	Numeric field (9 digits)
Security	None, WEP128, WEP64, WPA-PSK, WPA-LEAP, WPA-PSK64, WPA-PSK128, WPA-LEAP 64, WPA-LEAP128, WPA2-PSK, WPA2-PEAP
LAN MAC	XX XX XX XX XX XX
WLAN MAC	XXXXXXXXXXXX
SSID	Alphanumerical field (30 digits) (not on printout)

Summary of Configuration Menus (continued)

Configuration Parameter	Definition
WEP Key	Numeric (1 digit) (not on printout); valid range 1-4
WEP Key ID	Alphanumerical field (26 digits) A-F, 0-9 (not on printout)
PSK Passphrase	Alphanumeric field (64 digits) (not on printout)
LEAP User Name	Alphanumeric field (32 digits) (not on printout)
LEAP Password	Alphanumeric field (32 digits) (not on printout)
PEAP User Name	Alphanumeric field (63 digits) (not on printout)
PEAP Password	Alphanumeric field (63 digits) (not on printout)
Worklist Management	Standard or Refresh
Comm Protocol	UNIPRO32, DICOM32, DICOM32ext OR UNIPRO64, DICOM64 (V2.x software)
Sync Mode	None, XMT, XMT+Orders
Sync Date/Time	YES/NO
XMT Mandatory Fields	None, Last Name, ID, Last Name+ID

Configuration Settings

Software Version

Identifies the software version of your electrocardiograph.

Cart Number

Indicates which electrocardiograph acquired or transmitted a particular ECG.

Site Number

Identifies the site of your device. Site numbers designate the hospital, clinic, or institution for ECG records stored in an E-Scribe system and must be defined for transmitting and retrieving ECGs from that system. You can use up to four digits for the site number. Numbers from 0 – 4095 are supported.

Site Name

Defines your clinic, hospital, or office name. You can enter up to 30 alphanumeric characters. The site name prints at the bottom, left edge of the ECG printout.

Telephone Number

Specifies the telephone number for internal modem transmission to another unit or to an E-Scribe system. Enter up to 45 numeric characters.

You may need to dial a **9** to get an outside line. To wait for an additional dial tone, use the letter **W**.

EXAMPLE: 9**W**14145554321

To insert a pause, use a comma (**,**).
To change tone dialing to pulse dialing, use the letter **P**.

EXAMPLE: **P**14145554321

(If necessary, you can use both the letter **W** and the letter **P** in the same phone number.)

NOTE: *It is not necessary to use alpha characters in the telephone number with GSM/GPRS mobile connectivity.*

TIP: *To quickly delete or modify a phone number, use a shortcut. From the application screen, simultaneously press* **↑ (SHIFT) + ALT + P.** *To edit an existing telephone number, use the* ***Tab*** *key.*

Language

There are several languages available on the electrocardiograph.

CAUTION: *Function labels are immediately translated upon selecting a new language and exiting the configuration screen.*

If an unknown language is visible, use the following steps to revert to the language of your country:

1. **F6 (More)** from real-time ECG view.
2. Select **F5 (Set Time/Date).**
3. Simultaneously press ⇧ **(SHIFT) + ALT + C.**
4. Enter password (“admin”)
5. Press **F2 (▼)** four times.
6. Press **F3 (►)** until the desired language appears.
7. **F6 (Exit)** to return to real-time ECG view.

Alphabets of specific languages may require use of special characters in demographic fields. This is accomplished by using the **SYM** key on the keyboard.

Volume

Defines the keyboard click loudness. Available settings range from 0 (off) to 8 (loud).

Battery Time Out

Determines when the electrocardiograph will switch off in order to conserve the battery life of the device. The battery time out will only occur if the keyboard has not been depressed for the time specified. The battery time out setting is ignored if an active ECG signal is detected during transmission or while rhythm printing.

Flash Size

Indicates ECG storage capacity. Normal indicates standard memory capacity. Expanded indicates the optional expanded memory has been installed.

ID Format

Defines the format for the patient demographic information prompts. There are three standard formats: short, standard, or long. A custom ID format can be downloaded from ELI Link or an E-Scribe system. See Appendix A to download a custom ID.

The short format includes the patient's last and first name, patient ID number, date of birth (automatically calculates the age), and gender.

The standard format includes the patient's last name, patient ID number, age, height, weight, gender, race, medication 1, medication 2, and a location field.

The long format is identical to the standard format except that it includes the patient's first name, room, and comment fields.

Auto-Fill ID

When enabled, the device will automatically populate last name, first name, date of birth, age, and gender in the ID screen if records with matching patient ID are found in the ECG directory.

AC Filter

The device removes 60 Hz or 50 Hz interference. The setting you select depends on the line frequency in your country. Always use the 60 Hz setting in the U.S. If AC interference is present, check to see that the proper AC filter is selected.

Paper Speed

Configure to 25 mm/s or 50 mm/s for default ECG printouts. For rhythm printouts and display, speeds of 5 mm/s or 10 mm/s are also available. See Section 3 to change speeds for display or rhythm printing. Paper speed is printed at the bottom right corner of the ECG printout.

Filter

The ECG plot-frequency filter (or print filter) can be set to 0.05 to 40 Hz, 0.05 to 150 Hz, or 0.05 to 300 Hz. The plot-frequency filter does not filter the acquired digital record. A 40 Hz plot-filter setting will reduce the noise (40 Hz and higher frequencies) on the printed ECG, and a 150 Hz plot-filter setting will reduce the noise (150 Hz and higher frequencies) on the printout; a 300 Hz plot-filter setting will not filter the printed ECG. The filter setting is printed at the bottom right corner of the ECG printout.

Height/Weight Units

Defines the units of weight and height to either pounds/inches (lb/in) or kilograms/centimeters (kg/cm).

Date Format

Select either U.S. or European format for entering and displaying the patient's date of birth.

U.S. Date Format:	MM/DD/YYYY
European Date Format:	DD.MM.YYYY

NOTE: *The date format option does not modify the acquisition date printed on each ECG.*

Interpretation

The device automatically analyzes ECGs and prints the optional interpretation on the ECG printout. This setting allows you to select or suppress the "interpretive" text on the ECG report.

> ***NOTE:*** *The ECG interpretations offered by the device are only significant when used in conjunction with a physician over-read as well as consideration of all other relevant patient data.*

Reasons

The reasons statements indicate why a particular interpretive statement was printed. Reasons statements print enclosed in [square brackets] within the interpretive text if the interpretation option is turned on. Turning the reasons statement function on or off does not affect the measurements performed or the interpretive statements selected by the analysis program.

> **For Example:**
> Anteroseptal Infarct [40+ ms Q WAVE IN V1-V4]
> Where "Anteroseptal Infarct" is the interpretive statement,
> and "40+ ms Q WAVE IN V1-V4" is the reason statement or explanation as to why the interpretive statement was printed.

Append

A status or statement phrase can be appended to the ECG and printed under the interpretive text printout. Either "unconfirmed report" or "reviewed by" can be selected; however, if you wish to have nothing appended to the ECG, select "blank".

Number of Copies

Defines the number of printed copies when an ECG is taken. A zero (0) setting prints the original only; one (1) prints the original plus 1 copy; two (2) prints the original plus 2 copies, and so on. Up to 9 copies may be selected.

Copies with Interpretation

Defines whether or not printed copies will include interpretation. The clinician may request the first ECG printout with the interpretation included. Additional copies may be printed with or without the interpretation.

Number of ECGs Retrieved

Defines the number of ECGs retrieved from an E-Scribe system. The ECGs are retrieved by ID number. A zero (0) setting retrieves the most current ECG for that ID number. Settings from one (1) to seven (7) retrieve the most current ECG plus "X" number of ECGs identified by the entered value. EXAMPLE: If you enter the number 5, you will retrieve the most current ECG plus the five preceding ECGs for that ID number. ECGs retrieved from the E-Scribe are only printed at the device and not saved.

Delete Rule

Defines the rule to mark ECGs as deleted in the ECG directory. ECGs that are marked for deletion will be automatically removed or erased based on their acquisition date (a first-in/first-out philosophy) to make room for the new ECG record. ECGs are only erased from the directory when they are marked for deletion and if the directory becomes full. More than one ECG may be removed from the directory in order to make room for the new incoming record. The delete rule selections are:

Post Plot = ECG is automatically marked for deletion after printing
Post Transmit = ECG is automatically marked for deletion after transmission
Post Plot/Transmit = ECG is automatically marked for deletion after transmission and printing

Storage Sensitivity

Dictates the resolution of all stored ECG records. The sensitivity setting is either Normal or High. If the value is set to High, the stored ECG will have a high resolution. As a result, the record size will be large and will reduce the storage capacity in the ECG directory.

Auto-Save ECG

Defines whether or not a newly acquired ECG will be automatically saved to the directory once it is acquired and printed. If the auto-save configuration option is set to No and the record is printed, the device will prompt you to "Save ECG?" **F1** (**Save)** will store the ECG in the directory.

Auto-Print ECG

Defines whether or not the device will automatically print the ECG after acquisition. If the selected configuration option is set to No, a manual printout is possible.

Caps Lock

All character entry is translated to uppercase.

Use A4 Paper

The ELI 250c accommodates use of Z-fold thermal paper in either letter size (8.5 x 11 inches; 216 x 279 mm) or A4 size (8.27 x 11.69 inches; 210 x 297 mm). The provided paper tray spacer is required for use with A4 size paper.

Rhythm Formats

Defines the default values for rhythm printing. It is possible to set a 3 or 6-channel default rhythm format for the ELI 150c. For the ELI 250c, a 3, 6, or 12-channel default rhythm format is possible. Define rhythm leads one through three to customize a 3-channel rhythm printout or define rhythm leads one through six to customize the 6-channel rhythm printout.

Plot Format

Defines the default for one of the available plot formats in either standard or Cabrera presentation. Please note that regardless of the plot format selected, 10 seconds of 12 leads are always stored.

The ECG plot options are:

Format Option	ECG Data
3+1	2.5 seconds of 12 leads in a 3-channel format, plus 10-second rhythm strip of one user-selectable lead in a 1-channel format. Cabrera also available.
3 (ELI 150c only)	2.5 seconds of 12 leads in a 3-channel format. Cabrera also available.
6	5 seconds of 12-leads in a 6-channel format. Cabrera also available.
3+3	2.5 seconds of 12 leads in a 3-channel format, plus 10-second rhythm strip of user-selectable leads in a 3-channel format. Cabrera also available.
12 (ELI 250c only)	10 seconds of 12 leads in a one page printout.
6+6 (ELI 250c only)	5 seconds of 6 leads in a 6-channel format, plus 10-second rhythm strip of user-selectable leads in a 6-channel format. Cabrera also available.

Rhythm Leads

Displays continuous rhythm of selected ECG leads and permits printing of selected leads. User may toggle between selected leads, system set leads, or I, II, III, aVR, aVL, and aVF followed by V1, V2, V3, V4, V5, and V6.

NOTE: *Rhythm acquisition is not stored in memory, only printed.*

NOTE: *See Section 3 to acquire a rhythm printout.*

Average RR

Enabling this option will display an averaged RR value to appear on the report.

QTcB

Enabling this option will display a Bazett's corrected QT value on the report along with the default linear QTc value.

QTcF

Enabling this option will display a Fridericia corrected QT value on the report along with the default linear QTc value.

ECG Capture

Up to 5 minutes accumulated ECG data can be acquired internally for use with the Best 10 feature. The device automatically selects the best 10 seconds from within the 5-minute buffer.

Users can switch between BEST 10 or LAST 10 by selecting **F5 (More)** followed by **F5 (Last)** or **F5 (Best)** depending on the current view.

Band Mode

Use 850/1900 MHz (US) or 900/1800 MHz (EU). (Applies to ELI 150c only.)

Sync Media

Defines the default transmission setting. Select None, Modem, LAN, WLAN, or GSM/GPRS (GSM/GPRS option applies to ELI 150c only). Optional connectivity options which have been purchased and installed will be available for default selection.

An ELI x50c communicating over GPRS can be configured to automatically set its clock to match the time on a time sync server. The time sync server must return a time stamp in the ELI x50c's local time zone via the **daytime** protocol (RFC 867). The time sync server must have a public IP address, and the standard port is 13. The server must return the time in one of the following formats:

Format 1

day mon dd HH:mm:ss yyyy

Example

Wed Jul 15 17:05:49 2010

Format 2

hh.mm.ss tt mm/dd/yyyy

Example

02:38:51 PM 07/18/2011

Time sync servers running the Dimension 4 (http://www.thinkman.com/dimension4/index.htm) time sync software support Format 1.

DHCP

Defines whether the Dynamic Host Communication Protocol (DHCP) will be used to obtain an IP address. If DHCP is Yes, the network will automatically and dynamically assign an IP address. If DHCP is No, you must enter the IP address, def gateway, and sub net mask.

> ***NOTE:*** *All parameters related to network connection must be entered under the direction of the IT Manager of the facility where the device is installed.*

IP Address

Enter the fixed IP address for network transmissions (if DHCP is not selected).

Def Gateway

Enter the address of the default gateway (if DHCP is not selected).

Sub Net Mask

Enter the sub net address (if DHCP is not selected).

Host IP

Enter the IP address of the host server.

> ***NOTE:*** *Addresses are always entered as 4 sets of 3 digits; therefore, an address of 192.168.0.7 must be entered as 192.168.000.007.*

Port Number

Enter the port number used by the host server.

LAN MAC

Shows the MAC address of the LAN.

Security (WEP)

Wired Equivalent Privacy (WEP) is an encrypted security protocol (part of the 802.11 standard). Access points can have multiple WEP keys stored. Each one of them is identified by a number (e.g., 1, 2, 3, 4).

WEP Key

Enter the WEP key number.

WEP Key ID

Enter the 128-bit WEP key ID value (26 digits in 13 sets of two digits).

WLAN MAC

Shows the MAC address of the device's wireless module for configuring access points.

SSID

Service Set Identifier (SSID) is the name of the wireless network. All ELI 150c electrocardiographs that will transmit to the same network must have the same SSID name. This field is case sensitive.

WPA-PSK/WPA2-PSK

Allows for implementation of the "personal mode" of WPA. This mode of encryption employs Temporal Key Integrity Protocol (TKIP) which dynamically changes keys as the system is used.

PSK Passphrase

The passphrase may be from eight to 63 ASCII characters or 64 hexadecimal digits (256 bits).

WPA-LEAP

Cisco® LEAP (Light Extensible Authorization Protocol) enables use of the device with wireless networks employing the LEAP encryption protocol.

LEAP User Name

User name can be up to 32 characters in length.

LEAP Password

LEAP password can contain up to 32 characters.

WPA2-PEAP

Enables use of the device with wireless networks employing the PEAP encryption protocol.

PEAP User Name

User name can be up to 63 characters in length.

PEAP Password

Password can contain up to 63 characters.

Worklist Management

The device can download and process ECG order lists from the E-Scribe or another compatible information management system which identifies the ECGs (or ECG orders) needed for particular patients. Implementation of an order-based workflow can significantly reduce demographic data entry errors at the electrocardiograph. Orders are deleted from the list when the ordered ECG is acquired.

When set to Standard, new order lists are appended to the remaining list. When set to Refresh, each new order list will override the previously downloaded one.

Comm. Protocol

Select UNIPRO32, DICOM32, OR DICOM32ext for software v1.x.x. DICOM32 and DICOM32ext are only available if the DICOM option has been installed. Select UNIPRO64 OR DICOM64 FOR SOFTWARE V2.x.x. DICOM64 is only available if the DICOM option has been installed.

> ***NOTE:*** *This parameter must be entered under the direction of the IT Manager of the facility where the device is installed.*
>
> ***NOTE:*** *Units ship by default with Comm Protocol set to UNIPRO32. The UNIPRO32 setting is not supported by E-Scribe versions prior to V8.10 or ELI Link versions prior to V3.00. For questions about compatibility of your device with E-Scribe or ELI Link and UNIPRO32, contact Mortara Technical Support. Units shipped with v2.x.x software will not connect with E-Scribe and need Eli Link v4.0 or above.*

Sync Mode

Select None, XMT, or XMT+Orders. None requires a manual transmission of reports and then a second manual request to receive orders from the cardiology management system. XMT will automatically transmit the report; XMT+Orders will both transmit the report and retrieve the orders.

Sync Date/Time

Select Yes or No. Yes will synchronize the date/time with the approved cardiology management system. With No, there will be no date/time synchronization. Date/time synchronization is done through ELI Link V3.10 or later.

XMT Mandatory Fields

Defines fields required for ECG transmission to the cardiology management system. None will allow data transmission without limitation; Last Name requires the technician to enter a minimum of the Last Name; Last Name and ID requires the technician to enter a minimum of the Last Name and the patient's ID.

ELI 150c

ELI 250c

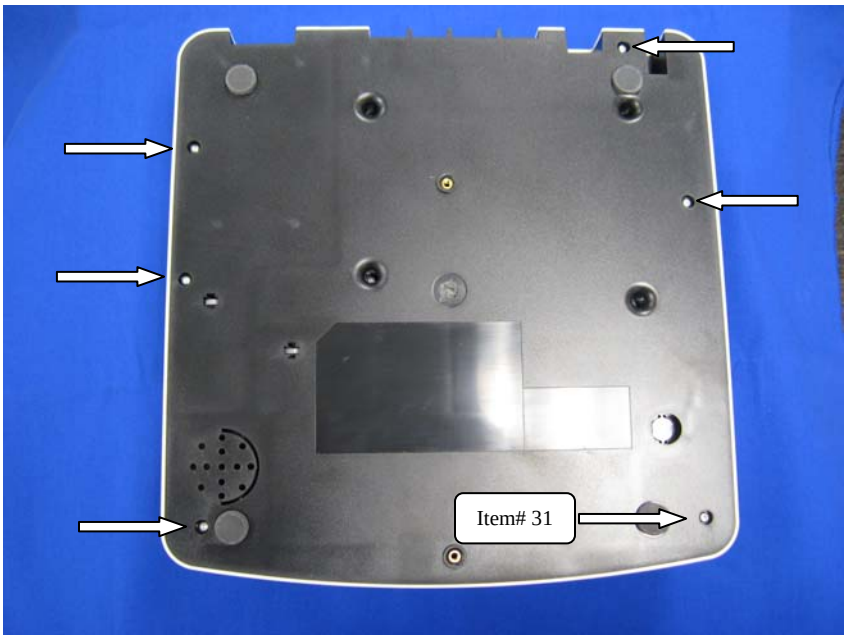
Removal of the Unit from Cart

Remove two thumbscrews from underneath the cart platform by turning counterclockwise. *Cart may not be exact model as pictured.

**The ELI 150c and ELI 250c are very similar in design, so only the ELI 150c will be shown, unless an important difference needs to be identified.*

Cover Assembly Removal

Turn the unit upside down and use a T10 Torx driver to remove the 6 housing screws shown below. Once the screws are removed, carefully flip the Device back over so that it is upright.

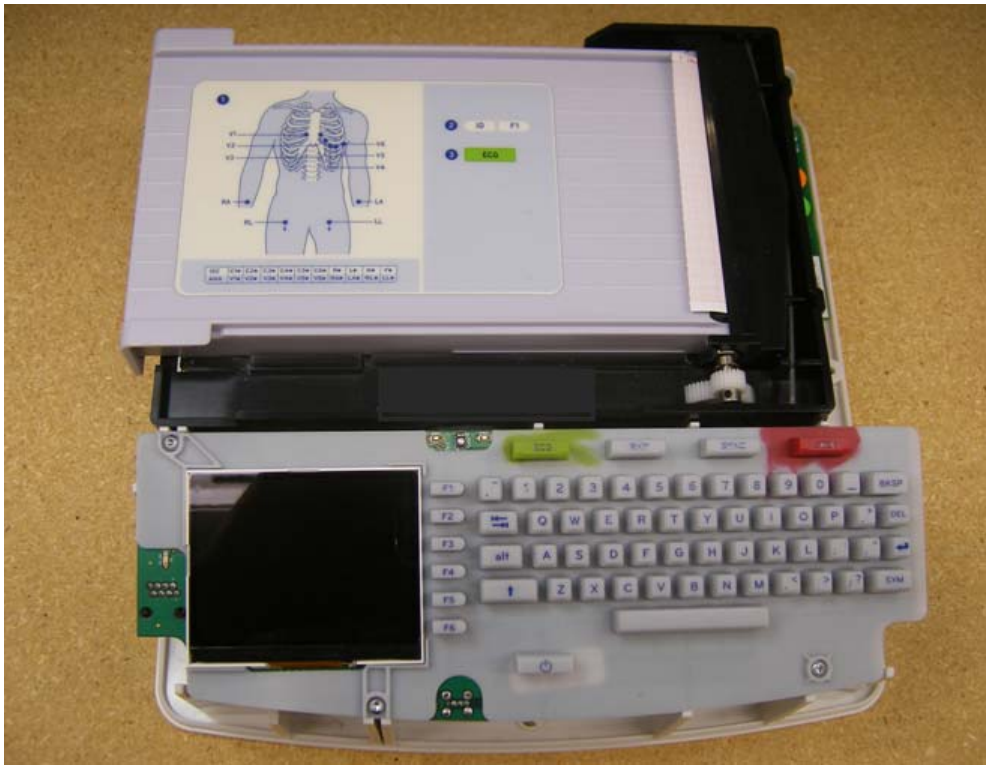


Open the writer drawer then lift the upper housing while rotating it counterclockwise according to the picture below. This will allow the writer cover to pass through the housing opening to free the upper housing.

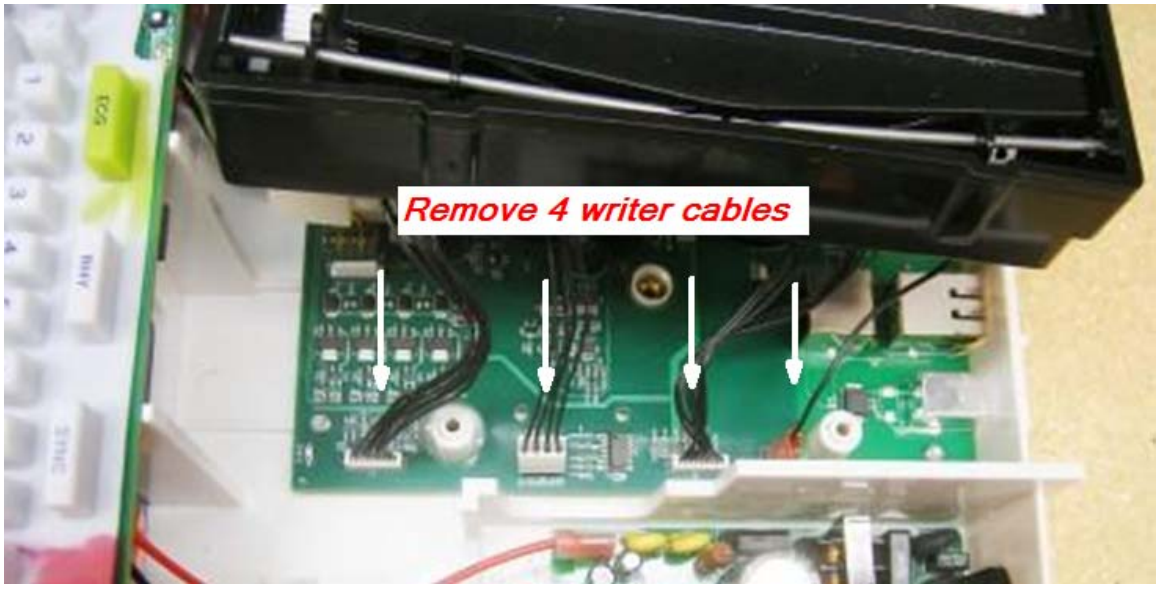
CAUTION: *Remove battery power to the unit by disconnecting the battery connector BEFORE removing the keyboard assembly. If battery power is not removed prior to disconnecting the keyboard cable, damage to the motherboard may result.*

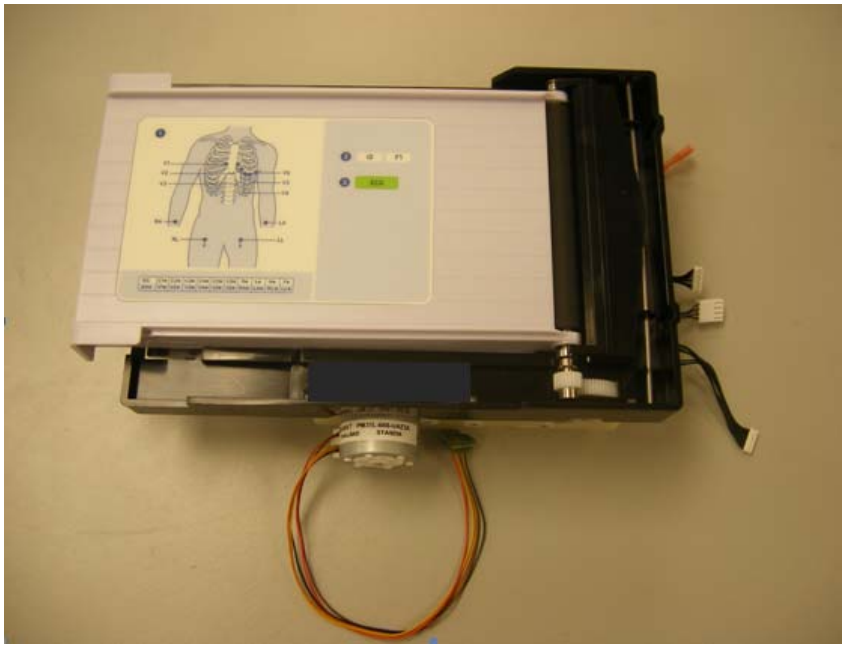
Writer Removal

To remove the writer assembly, remove the 4 chassis screws shown below. Once they are removed, carefully turn the unit over supporting the loose writer to ensure the cable connections are not stressed during the process.

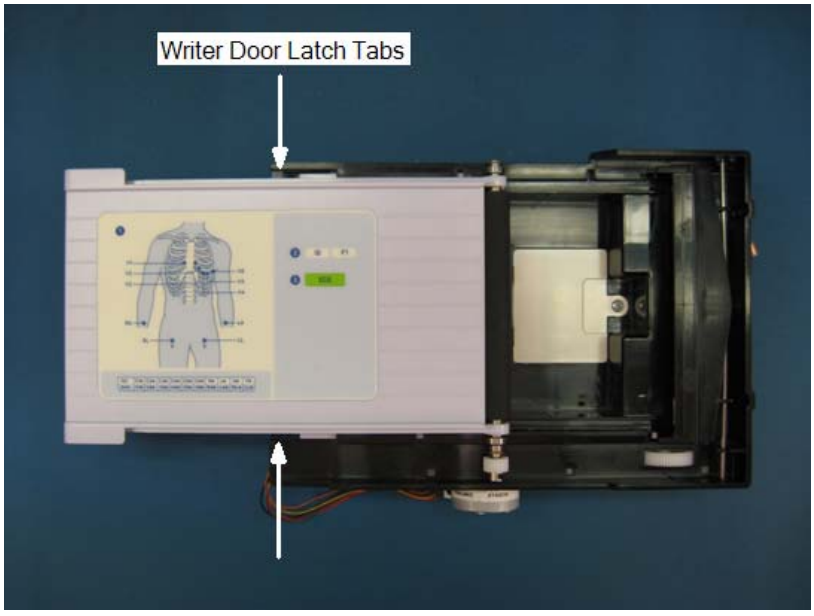


Disconnect the writer interface cables and the motor cable shown below, then remove the writer assembly.



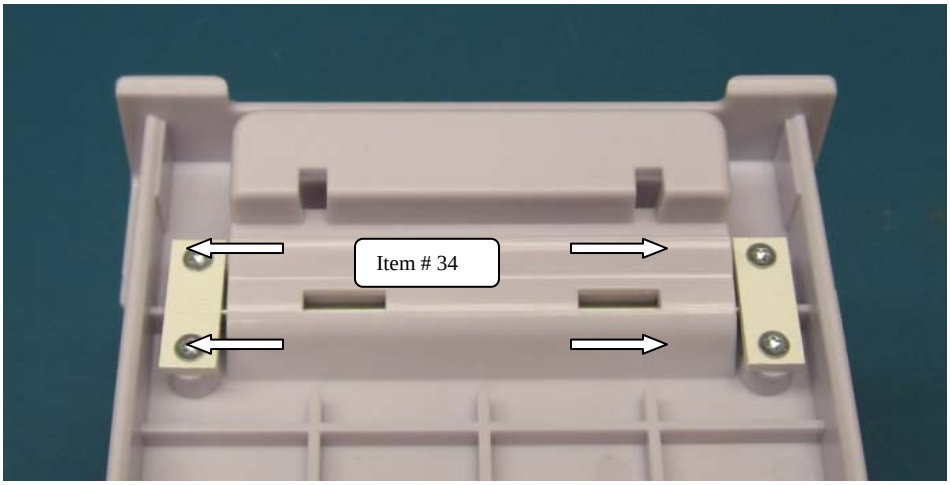


NOTE*: *The writer assembly can be obtained as a complete assembly for service purposes, or a specific part or subassembly can be obtained to repair a specific writer related issue. The entire writer door with the platen roller, latch assembly, and instruction label attached is available as an assembly; and the thermal print head, print head mount, anti-static brush, and associated cables are also available as an assembly. (Refer to the SERV ASSY item numbers on the item listing at the end of this section of the manual).

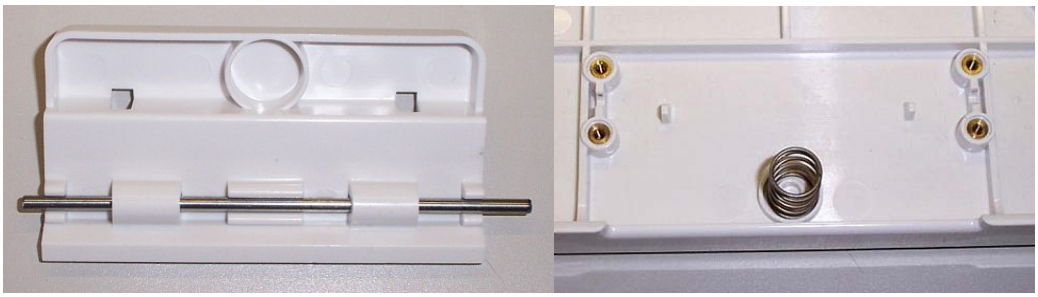


To remove the writer door assembly, slide the door open and press downward on the latching tabs to allow the writer door assembly to be slid out.

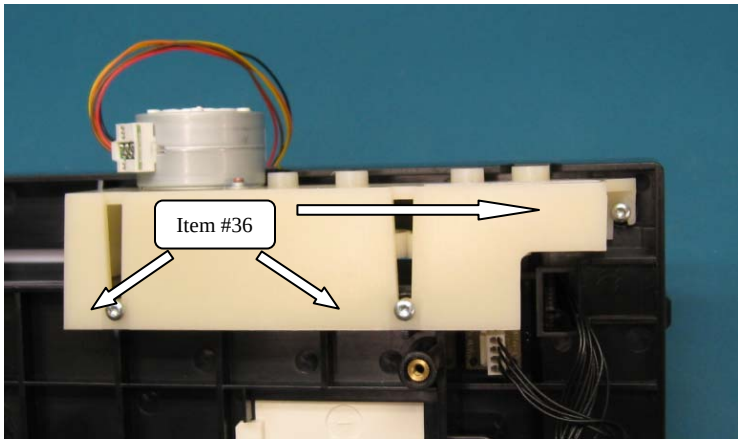
The writer latch mechanism can be disassembled to gain access to the writer latch bar and spring by removing the 4 screws shown below.



(View below with screws removed)

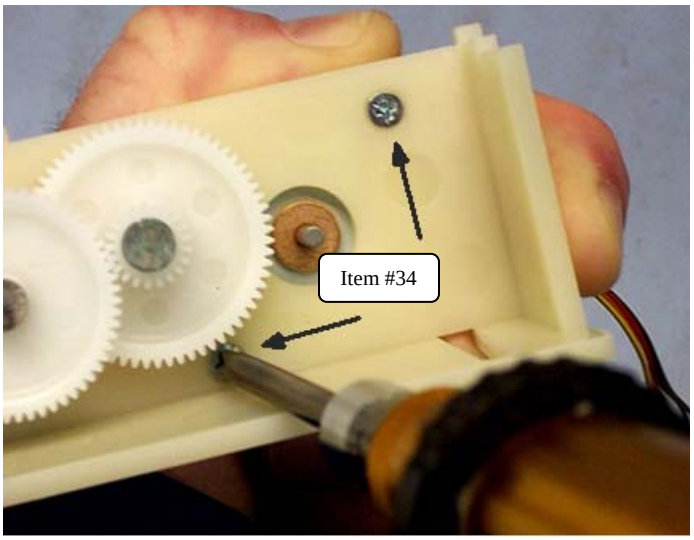


To remove the Gearbox assembly, remove the three screws as shown in the illustration below.



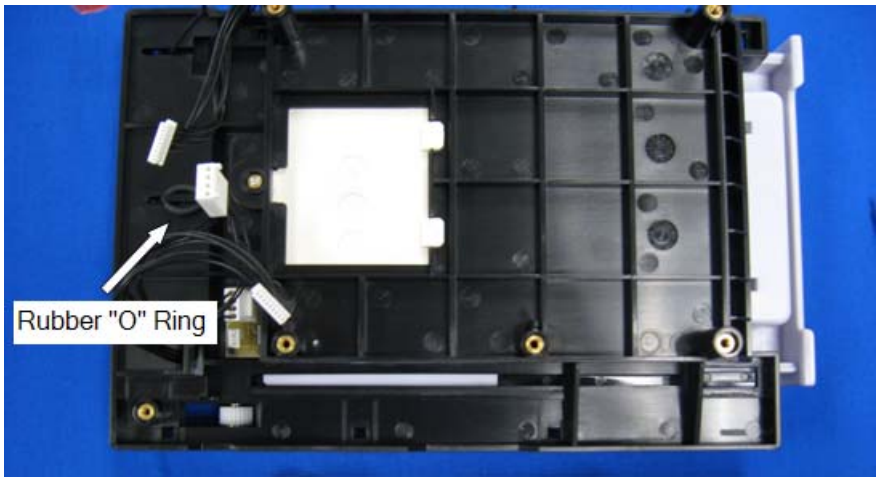
To remove the writer motor, the pinion gear must be removed by loosening the pinion set screw as shown above.

> ***NOTE*****:** *The set screw is installed at the factory with a Vibra-Tite coating to prevent loosening due to vibration; ensure a coated set screw is used when reinstalling a new motor. The set screw should be tightened to a torque 3.5 pound inches to ensure a proper connection to the motor shaft.*

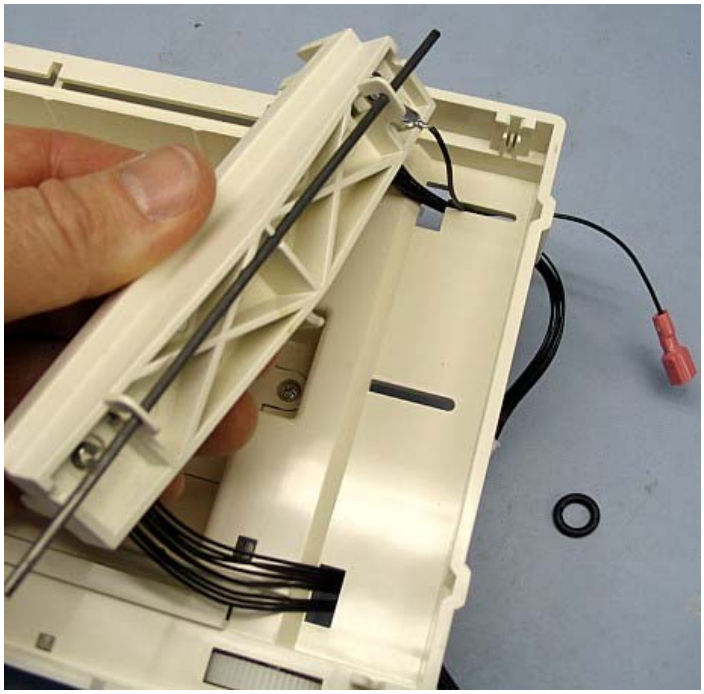


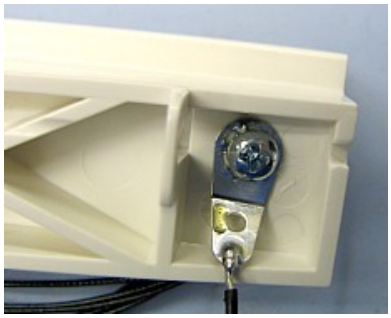
The motor can then be removed by the removal of the two mounting screws shown above (actual screws are TORX head for this product).

To remove the thermal print head assembly, remove the rubber O-ring as indicated in the illustration below.

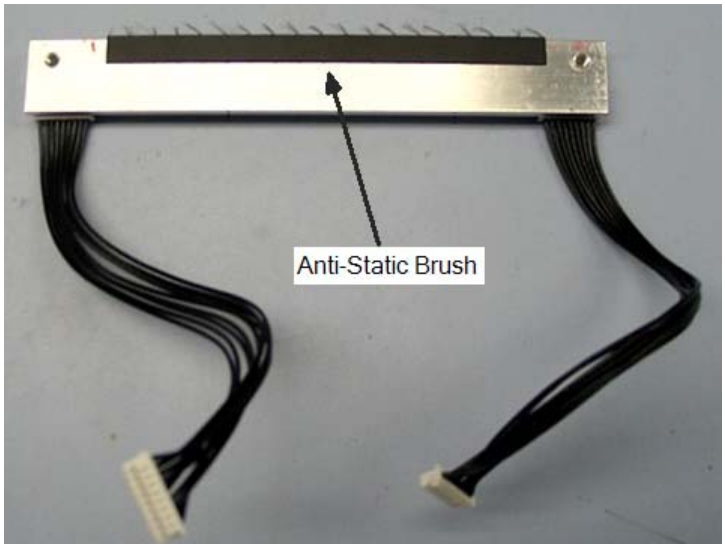


Next, flip the writer assembly over and lift the thermal print head assembly out, taking care to feed the wires through the writer base slots (shown below) as it is removed.





If the Print head assembly is disassembled further into the individual parts, care should be taken to re-torque the ground screw to 3.5 pound inches during reassembly; the shoulder screw can be tightened completely as it allows the Print head and mount to expand and contract when the device is exposed to abrupt temperature changes. When replacing the Print head, keep in mind that the anti-static brush is a separate item and can not be reused from the old Print head.



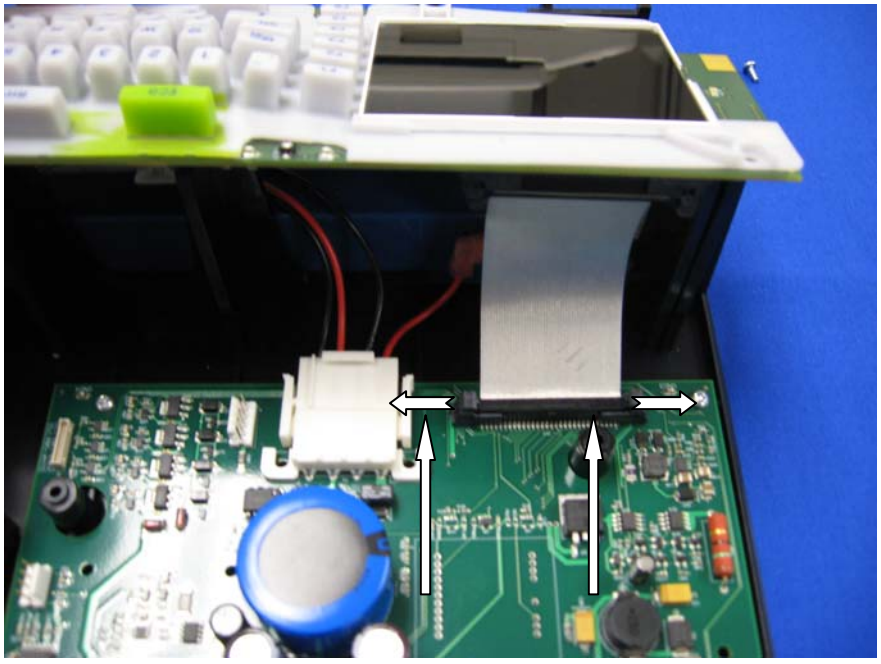
NOTE**:** *When repairing units with symptoms of light or uneven print darkness, Mortara recommends that the entire Print head assembly be replaced to ensure the problem resolved completely. Slight variances in the shape of the Print head and/or the print head mount can result in the unit exhibiting these symptoms. Replacement of the entire assembly will ensure the problem is completely resolved. (Refer to the SERV ASSY item numbers on the item listing at the end of this section of the manual).*

Keyboard Removal

CAUTION: *Remove battery power to the unit by disconnecting the battery connector BEFORE removing the keyboard assembly. If battery power is not removed prior to disconnecting the keyboard cable, damage to the motherboard may result.*

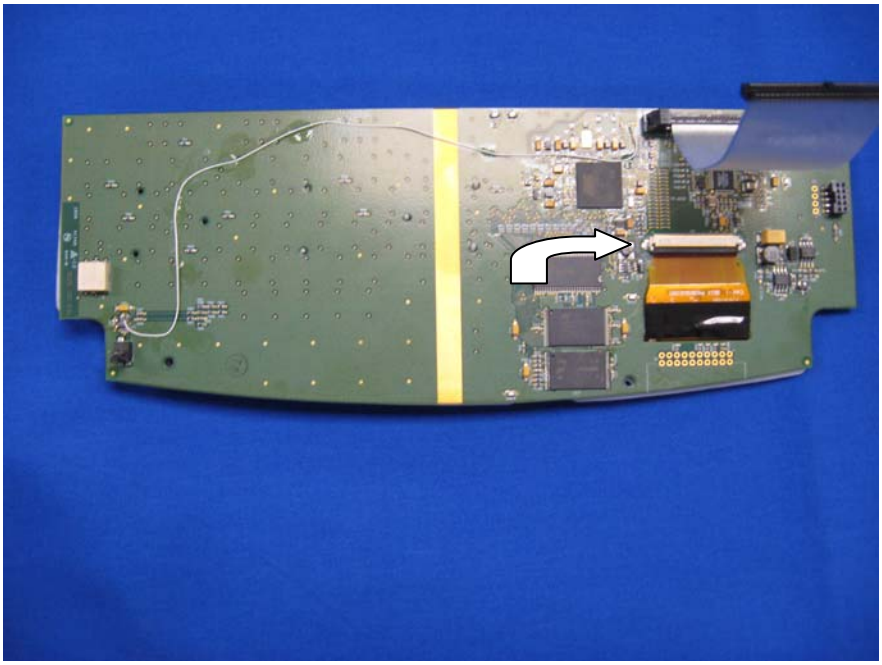
Remove the 3 keyboard mounting screws which fasten the keyboard to the unit's lower housing (150c only).

Next, press firmly and outward on the keypad connector hold-downs (as shown below) to release the keyboard ribbon cable; then remove the keypad assembly from the bottom housing.

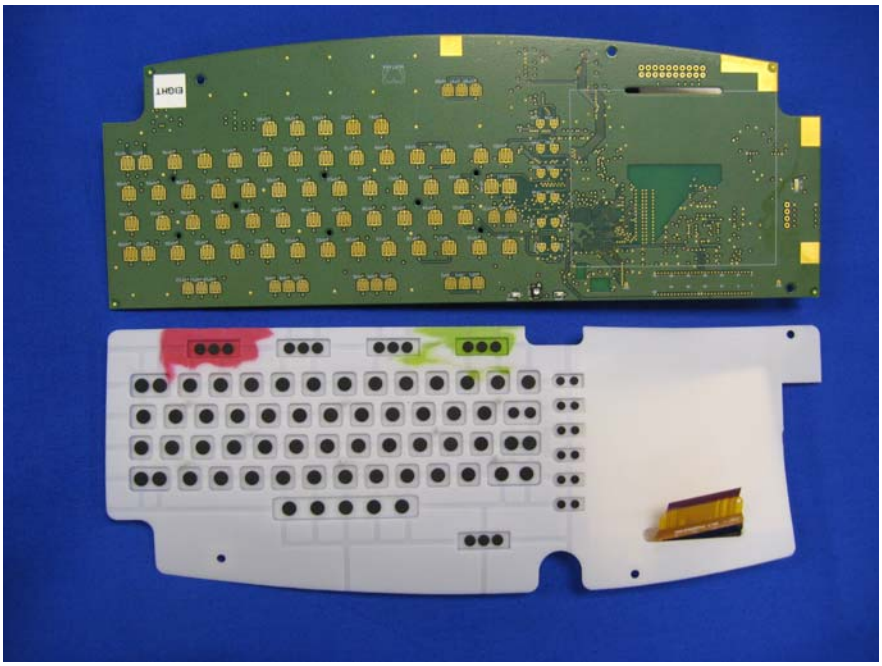


To remove the LCD Display, use a small flat blade screwdriver to lift up the latch mechanism that holds the LCD ribbon cable into the connector; then slide the cable out of the connector.

Be careful not to apply excessive force, as this connector mechanism is very small and fragile.



The rubber keypad and LCD can then be separated from the keyboard PCB assembly.

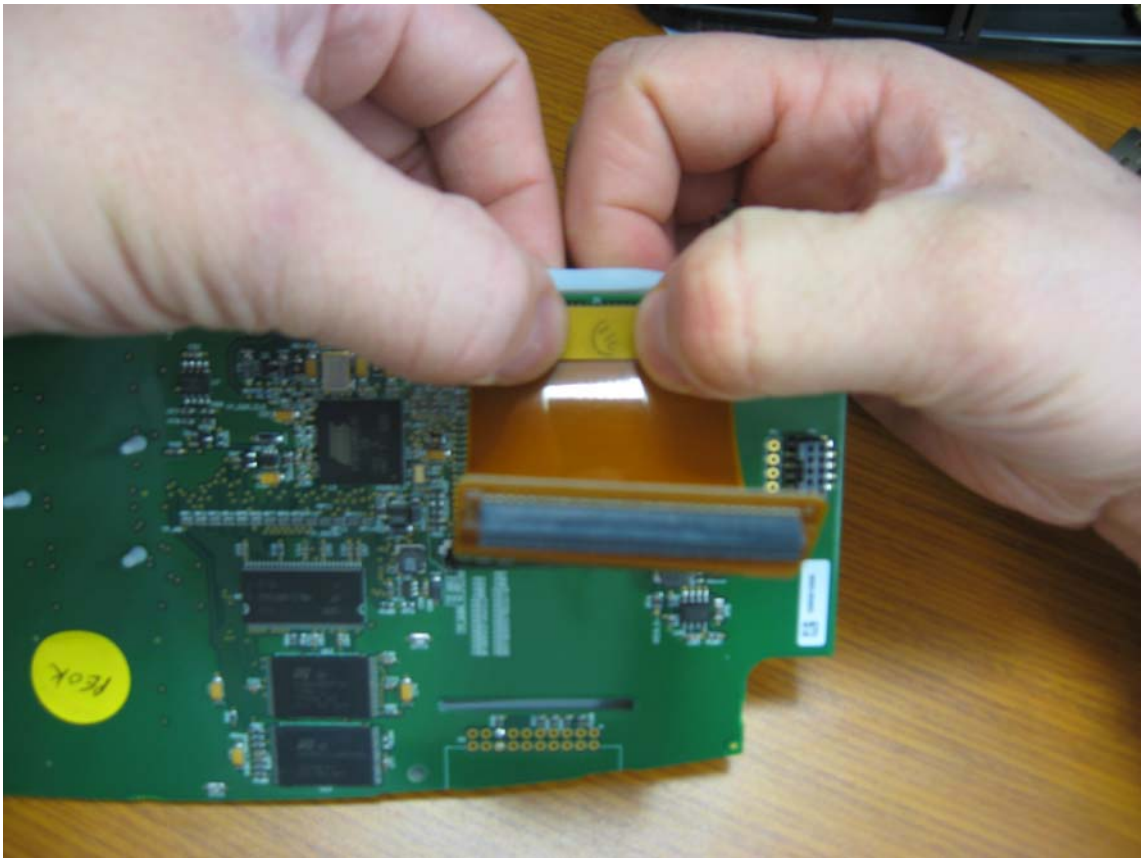


NOTE*: *When troubleshooting key press related issues, careful inspection and cleaning of the key pucks and PCB contacts should be performed prior to any electrical troubleshooting.

Installation of the Ribbon Cable to the Keypad Assembly

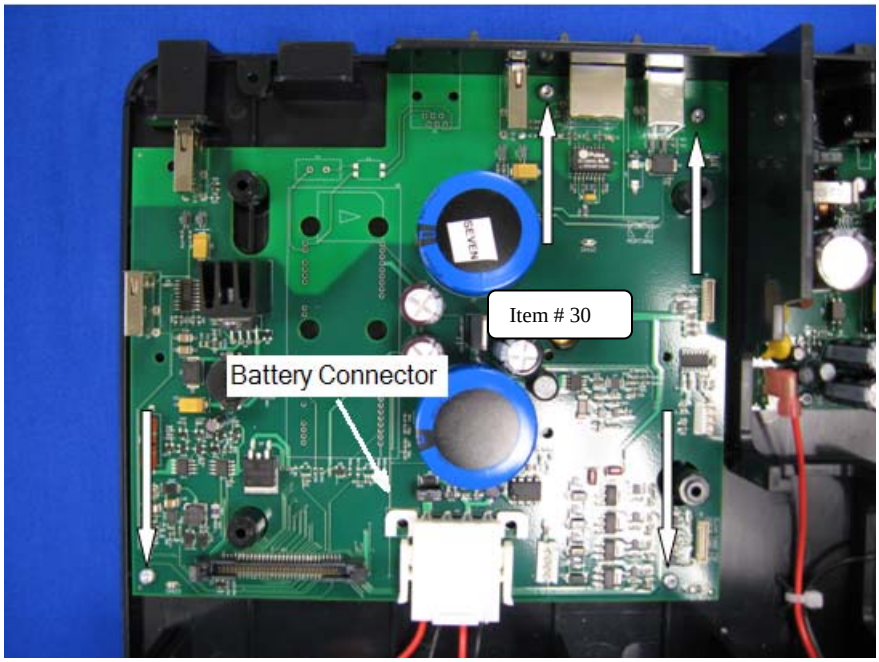
The Main Processor is located on the Keypad Motherboard. When installing the ribbon cable onto the circuit board, it is imperative to install using the following process. If care is not taken when pressing the ribbon cable into the connector, damage to the solder connections to the Ball Grid Array of the processor due to flexing of the printed circuit board assembly could occur.

To install, ensure that the cable connector is correctly aligned with the board connector. Grasp the keypad side of the board with your forefingers, and press with equal pressure with both thumbs on the ribbon connector. Some force may be required to fully seat this connector. See picture below:

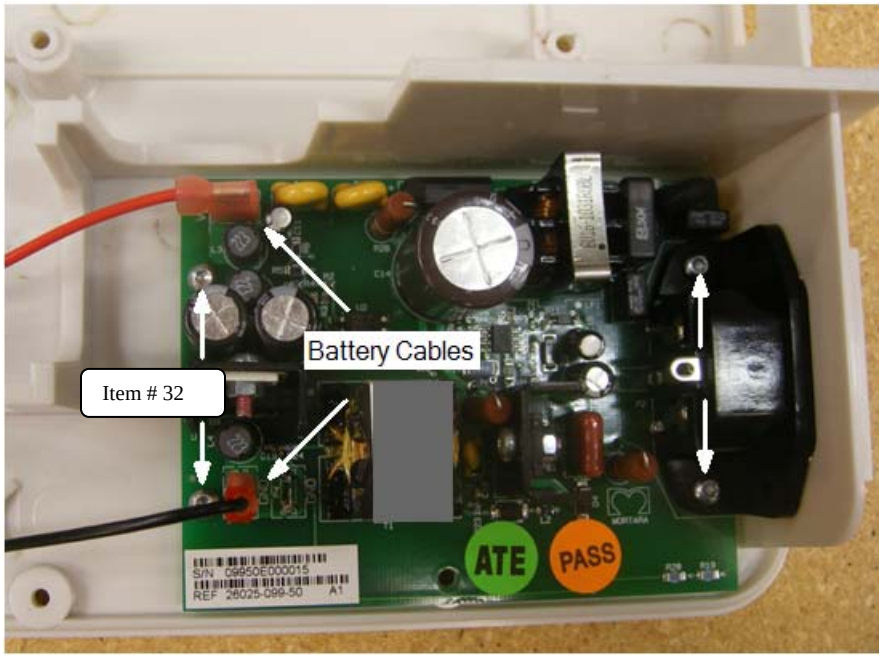


I/O Board Removal

Be sure the battery connector is disconnected, then remove the four screws as shown in illustration below.



To remove the Power Supply, disconnect the battery cables and then remove the 4 mounting screws as shown in illustration below.

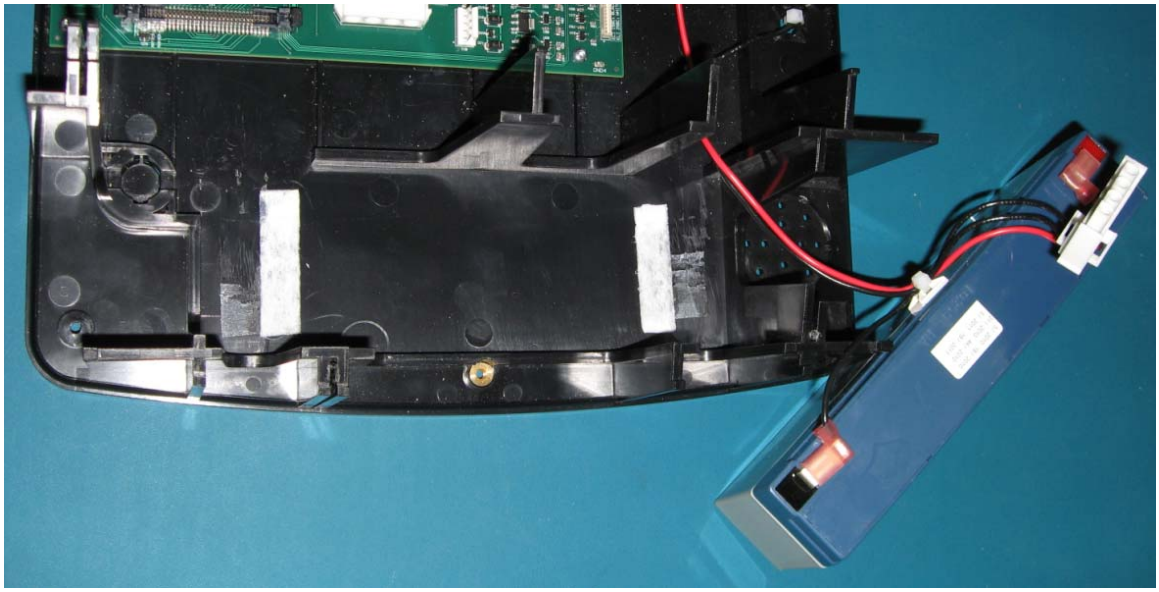


Battery Replacement

***CAUTION*:** *Be careful not to short the positive and negative terminals of the battery with a metal tool when removing the battery from the unit; as this could result in damage to the unit, or personal injury to the repair technician.*

The battery is installed at the factory by adhering it to the lower housing with two pieces of double stick foam tape. To remove the battery, insert a small prying tool underneath the battery in the area shown below; then carefully lift the battery edge to separate the battery from the lower housing. Removal of the battery will require a fair amount of force, as the foam tape will typically tear in the center leaving the adhesive portions on the battery and lower housing.

The adhesive left on the lower housing (as shown below) will need to be removed with a small scraping tool prior to installation of the new battery.



NOTE*: *Mortara recommends that a battery assembly that includes the pre-mounted foam tape be obtained for battery replacements that are not performed in a Mortara Service Center. This will ensure that the battery is properly adhered to the lower housing to avoid it being dislodge during use, and will allow for proper removal for routine maintenance. (Refer to the SERV ASSY item numbers on the item listing at the end of this section of the manual).

Reassembly of the ELI 150c/250c can be performed by reversing the sequence of the previous disassembly procedure.

The items highlighted in grey that are listed in the ELI 150c item description listing identify the serviceable level of the device.

Some subcomponents of assemblies listed are not available as individual service items from Mortara, the assembly level item must be used for servicing purposes.

Item numbers below 100 are also used with the ELI 150c. Item numbers above 100 are specific to ELI 250c.

ELI 150c Item Description Listing

Item #	Part #	Description
1	22500-150-51	WRITER ASSEMBLY ELI/BUR 150c - NO LABEL (See Item # 74 for ELI or BUR label part number)
2	25018-034-50	CABLE ASSEMBLY ELI 200+ PRINTHEAD TO PCB
3	25020-060-50	CABLE ASSY CUE SENSOR TO MTHRBD ELI 200+
4	25020-067-50	GROUND WIRE FOR ELI 230 PRINTHEAD
5	25020-076-50	CABLE POWER INTERNAL ELI 150c
6	26025-045-151	ELI 200+ CUE SENSOR PCB ASSEMBLY
7	26025-073-50	SIM SIMULATOR PCB ASSEMBLY
8	26025-074-50	REMOTE SIM CONNECTOR PCB ASSEMBLY
9	26025-077-170	B&B-N WLAN MODULE PCB ASSY
10	26025-102-150	ELI 150c KEYBOARD PCB ASSEMBLY
11	26025-110-150	ELI 150c FLEX CABLE INTERCONNECT
12	3171-009	CABLE ASSY COAX 6" SMA-F BLKHD to MMCX-M
13	3171-010	CABLE COAX U.FL TO RP-SMA BLKHD 100mm
14	3225-003	CONN, MOD PHONE, 4 PIN, RA, LO PRO
15	3225-008	CONN RJ-45 8 PIN SHIELDED w/GREEN LEDS
16	3375-004	CONN USB RECEPTACLE TYPE B
17	3375-006	CONN USB RECEPT TYPE A UPRIGHT HIGH RET
18	3600-008	ANTENNA F1 900/1800 MHz HINGED RA
19	3600-009	ANTENNA F2 850/1900 MHz RIGHT ANGLE
20	3600-016	ANTENNA DUAL BAND 2400/5000 MHz
21	4027-001	FUSE POLYSWITCH TR 600V 150mA
22	4027-002	FUSE 1A 250V TIME LAG RADIAL 8x8.5x4mm
23	4027-003	FUSE 5A 250V TIME LAG RADIAL 8x8.5x4mm
24	4800-006	BATTERY RECHARGEABLE SLA 12V 2.2/2.3Ah
25	5400-019	LCD 3.5" TFT ACTIVE MATRIX 320 x 240
26	5450-005	PRINTHEAD THERMAL 108mm 4.25"
28	600-0515	COMMON MODE CHOKE 2A 4 PIN SM
29	6001-002-01	SCREW, SHOULDER HEX M3 x 0.5 STAINLESS
30	6020-060	SCREW THD-FORM PAN HD TORX 4-20x1/4"
31	6020-061	SCREW THD-FORM PAN HD TORX 4-20x1/2"
32	6020-062	SCREW THD-FORM PAN HD TORX 4-20x3/8"
33	6020-430-02	SCREW PHILLIPS PAN HEAD M3 X 6mm COATED
34	6020-735-02	SCREW FLAT HD TORX M3 x 6 COATED
35	6020-835	SCREW PAN HD TORX M3 x 8
36	6020-835-02	SCREW PAN HD TORX M3 x 8 COATED

ELI 150c Item Description Listing

Item #	Part #	Description
37	6030-025	SET SCREW SOCKET M2.5 x 4
38	6100-004	WASHER, WAVE, .006/.030 x .18 x .25
39	6125-004	SPACER .19 x .25 x .125
40	6125-017	SPACER .19 X .25 X .063
41	6140-003	E-RING FOR 0.187 SHAFT ZN-PLATED STEEL
42	6141-003	O-RING BUNA-N 1/2 OD X 5/16 ID
43	6160-003	STANDOFF NYLON SNAP BOTH ENDS 0.062 BD
44	6320-003	FOOT BLACK .64 OD X .115 ADHESIVE
45	6520-003	BEARING BALL .1875ID SS
46	6545-007-01	MOTOR STEPPER PM 35mm 24V 40Ohm WINDINGS
47	6570-420-01	PLATEN / SHAFT 4.200 x 0.551 DIA
48	7400-019	TAPE POLYESTER FILM 1" X .05mm
49	7401-003	TAPE 2SIDED ADHESIVE 0.031 THK x.50 WIDE
50	7403-001	VIBRA-TITE 1oz
51	7480-090	BRUSH ANTI-STATIC 90mm FLEXIBLE
52	7495-001	CABLE TIE LOCKING 3.9 x .10
58	8342-004-50	GEAR BOX ASSEMBLY ELI 200+
59	8342-008-02	LATCH RELEASE ELI 250c
60	8342-009-01	GEAR SPUR 22 TEETH WITH STAINLESS HUB
61	8342-018-01	BAR RELEASE PIVOT 3.950 X .118 DIA.
62	8342-019-01	SPRING COMPRESSION .5 OD X .85 L
63	8342-020-01	PIVOT BAR RESTRAINING PLATE
64	8347-004-51	PAPER TRAY ELI 150c
65	8347-005-51	PAPER TRAY COVER ELI 150c
66	8347-006-51	PRINTHEAD MOUNT ELI 150c
67	8347-007-51	ACCESS COVER ELI 150c
68	8347-009-50	SPRING BAR 6.1 x 0.093 DIA
69	8359-001-50	HOUSING UPPER ELI 150c
70	8359-002-50	HOUSING LOWER ELI 150c
71	8359-003-50	KEYPAD ELASTOMERIC ELI 150c UNIVERSAL
72	8359-004-51	LCD BEZEL ELI/BUR 150c
73	9025-049-02	LABEL ELI 2XX MULTITECH MODEM ID
74	9042-073-01 9042-073-02	LABEL ELI 150c USER INSTRUCTIONS LABEL BUR 150c USER INSTRUCTIONS BURDICK
75	9050-059-05	LABEL REG MT GSM F4
76	9050-059-06 9050-059-09 9050-059-10	LABEL REG WLAN DPAC-G2 LABEL REG WLAN QUATECH-G2 LABEL REG WLAN B&B
77	9050-059-07	LABEL REGULATORY UTK
78	9050-086-01 9050-086-02	LABEL ELI 150c NAMEPLATE LABEL ELI 150c INMETRO NAMEPLATE
79	9910-017	MODEM MULTITECH MT5600 V.92 5V SERIAL
80	9910-022	MODEM GSM MT SCKTMOD F4 QUAD-BAND US/EU

ELI 150c Item Description Listing		
Item #	**Part #**	**Description**
81	26025-099-151	AC POWER SUPPLY 16VDC PCB ASSY w/UL
	26025-105-151	ELI 150c/250c I/O CONNECTOR PCB ASSEMBLY w/o COMM
	26025-105-152	ELI 150c/250c I/O CONNECTOR PCB ASSY w/MODEM
	26025-105-153	ELI 150c/250c I/O CONNECTOR PCB ASSY w/GSM
82	26025-105-154	ELI 150c/250c I/O CONNECTOR PCB ASSY w/LAN+WLAN
83	SERV-ASSY-177-01	BATTERY 12V 2.2/2.3Ah WITH FOAM TAPE
84	SERV-ASSY-177-02	ELI/BUR 150C WRITER LID ASSEMBLY – NO LABEL (See Item # 74 for ELI or BUR label part number)
85	41000-028-53	ELI150C PRINTHEAD ASSEMBLY
90	26025-092-151	USB TRANSCEIVER KEY (UTK) ASSEMBLY

The items highlighted in grey that are listed in the ELI 250c item description listing identify the serviceable level of the device.

Some subcomponents of assemblies listed are not available as individual service items from Mortara, the assembly level item must be used for servicing purposes.

Item numbers below 100 are also used with the ELI 150c. Item numbers above 100 are specific to ELI 250c.

ELI 250c Item Description Listing		
Item #	**Part #**	**Description**
101	22500-250-50	WRITER ASSEMBLY ELI 250c – NO LABEL (See Item # 122 for ELI or BUR label part number)
102	25018-046-50	CABLE ASSY BLK PRINTHEAD TO PCB ELI 250c
103	25018-047-50	CABLE ASSY WHT PRINTHEAD TO PCB ELI 250c
104	25020-074-50	CABLE ASSY CUE SENSOR TO PCB ELI 250c
105	25020-075-50	GROUND WIRE FOR ELI 250c PRINTHEAD
106	25020-077-50	CABLE POWER INTERNAL ELI 250c
6	26025-045-151	ELI 200+ CUE SENSOR PCB ASSEMBLY
9	26025-077-170	B&B-N WLAN MODULE PCB ASSY
107	26025-108-150	ELI 250c KEYBOARD PCB ASSEMBLY
13	3171-010	CABLE COAX U.FL TO RP-SMA BLKHD 100mm
14	3225-003	CONN, MOD PHONE, 4 PIN, RA, LO PRO
15	3225-008	CONN RJ-45 8 PIN SHIELDED w/GREEN LEDS
16	3375-004	CONN USB RECEPTACLE TYPE B
17	3375-006	CONN USB RECEPT TYPE A UPRIGHT HIGH RET
20	3600-016	ANTENNA DUAL BAND 2400/5000 MHz
21	4027-001	FUSE POLYSWITCH TR 600V 150mA
22	4027-002	FUSE 1A 250V TIME LAG RADIAL 8x8.5x4mm
23	4027-003	FUSE 5A 250V TIME LAG RADIAL 8x8.5x4mm
24	4800-006	BATTERY RECHARGEABLE SLA 12V 2.2/2.3Ah
25	5400-019	LCD 3.5" TFT ACTIVE MATRIX 320 x 240

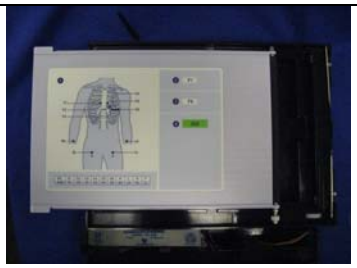
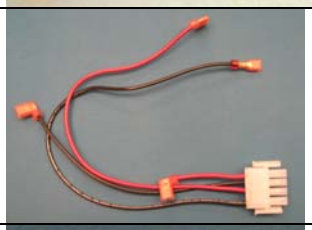
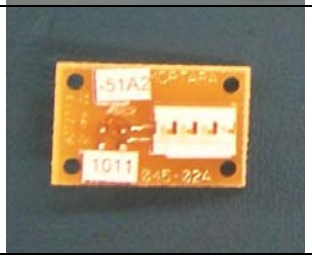
ELI 250c Item Description Listing

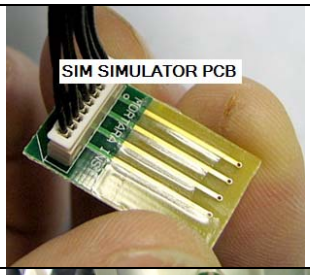
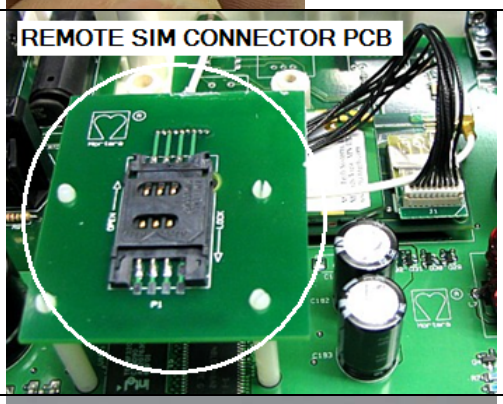
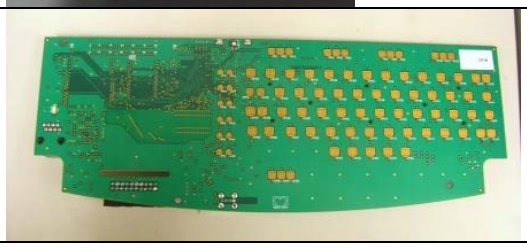
Item #	Part #	Description
108	5450-004	PRINTHEAD THERMAL 216mm 8.50"
28	600-0515	COMMON MODE CHOKE 2A 4 PIN SM
29	6001-002-01	SCREW, SHOULDER HEX M3 x 0.5 STAINLESS
30	6020-060	SCREW THD-FORM PAN HD TORX 4-20x1/4"
31	6020-061	SCREW THD-FORM PAN HD TORX 4-20x1/2"
32	6020-062	SCREW THD-FORM PAN HD TORX 4-20x3/8"
34	6020-735-02	SCREW FLAT HD TORX M3 x 6 COATED
35	6020-835	SCREW PAN HD TORX M3 x 8
36	6020-835-02	SCREW PAN HD TORX M3 x 8 COATED
37	6030-025	SET SCREW SOCKET M2.5 x 4
38	6100-004	WASHER, WAVE, .006/.030 x .18 x .25
39	6125-004	SPACER .19 x .25 x .125
40	6125-017	SPACER .19 X .25 X .063
41	6140-003	E-RING FOR 0.187 SHAFT ZN-PLATED STEEL
42	6141-003	O-RING BUNA-N 1/2 OD X 5/16 ID
44	6320-003	FOOT BLACK .64 OD X .115 ADHESIVE
45	6520-003	BEARING BALL .1875ID SS
46	6545-007-01	MOTOR STEPPER PM 35mm 24V 40Ohm WINDINGS
109	6570-420-01	PLATEN / SHAFT 8.421 x 0.551 DIA
49	7401-003	TAPE 2SIDED ADHESIVE 0.031 THK x.50 WIDE
50	7403-001	VIBRA-TITE 1oz
51	7480-090	BRUSH ANTI-STATIC 90mm FLEXIBLE
52	7495-001	CABLE TIE LOCKING 3.9 x .10
110	7495-012	CABLE TIE, LOCKING, 5.6 x .10
113	8342-003-51	PAPER TRAY COVER ELI 250c
114	8342-004-51	GEAR BOX ASSEMBLY ELI 200+ IMPROVED MESH
115	8342-005-51	PAPER TRAY ELI 250c
116	8342-006-03	PRINTHEAD MOUNT ELI 250c
59	8342-008-02	LATCH RELEASE ELI 250c
60	8342-009-01	GEAR SPUR 22 TEETH WITH STAINLESS HUB
117	8342-017-01	SPRING BAR 10.125 X .156 DIA.
61	8342-018-01	BAR RELEASE PIVOT 3.950 X .118 DIA.
62	8342-019-01	SPRING COMPRESSION .5 OD X .85 L
63	8342-020-01	PIVOT BAR RESTRAINING PLATE
118	8342-025-50	RETAINER CLIP ELI 2XX WRITER SPRING BAR
119	8360-001-50	HOUSING UPPER ELI 250c
120	8360-002-50	HOUSING LOWER ELI 250c
121	8360-003-50	KEYPAD ELASTOMERIC ELI 250c
73	9025-049-02	LABEL ELI 2XX MULTITECH MODEM ID
122	9042-074-01 9042-074-02	LABEL ELI 250c USER INSTRUCTIONS LABEL BUR 250c USER INSTRUCTIONS-BURDICK
76	9050-059-06 9050-059-09	LABEL REG WLAN DPAC-G2 LABEL REG WLAN QUATECH-G2

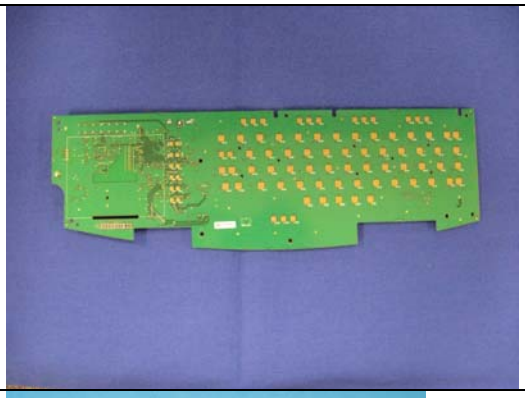
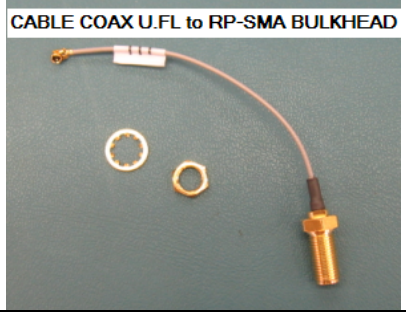
ELI 250c Item Description Listing		
Item #	**Part #**	**Description**
	9050-059-10	LABEL REG WLAN B&B
77	9050-059-07	LABEL REGULATORY UTK
123	9050-087-01 9050-087-02	LABEL ELI 250c NAMEPLATE LABEL ELI 250c INMETRO NAMEPLATE
124	9326-002	ADHESIVE CYANOACRYLATE ESTER
79	9910-017	MODEM MULTITECH MT5600 V.92 5V SERIAL
81	26025-099-151	AC POWER SUPPLY 16VDC PCB ASSY w/UL
82	26025-105-151 26025-105-152 26025-105-154	ELI 150c/250c I/O CONNECTOR PCB ASSEMBLY w/o COMM ELI 150c/250c I/O CONNECTOR PCB ASSY w/MODEM ELI 150c/250c I/O CONNECTOR PCB ASSY w/LAN+WLAN
83	SERV-ASSY-177-01	BATTERY 12V 2.2/2.3Ah WITH FOAM TAPE
125	SERV-ASSY-178-02	ELI/BUR 250C WRITER LID ASSEMBLY – NO LABEL (See Item # 122 for ELI or BUR label part number)
126	41000-028-52	ELI250C PRINTHEAD ASSEMBLY
127	8360-004-50	LCD BEZEL ELI/BUR 250c
90	26025-092-151	USB TRANSCEIVER KEY (UTK) ASSEMBLY

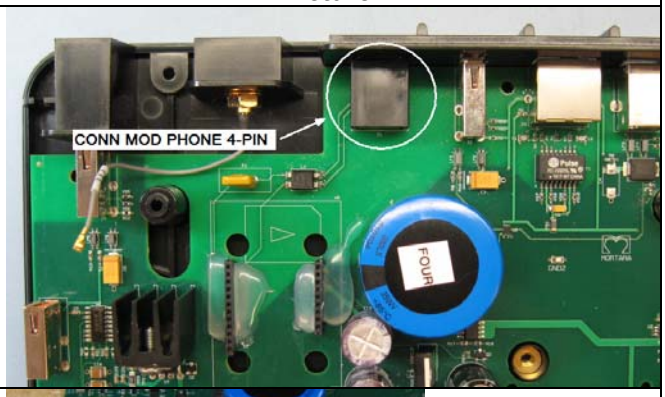
Item numbers below 100 are also used with the ELI 150c. Item numbers above 100 are specific to ELI 250c.

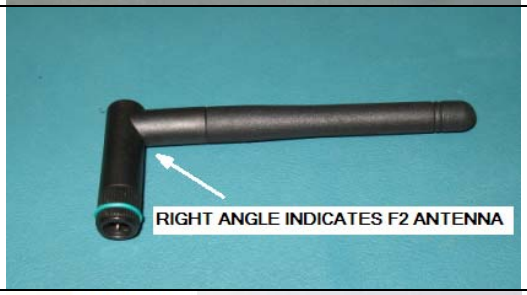
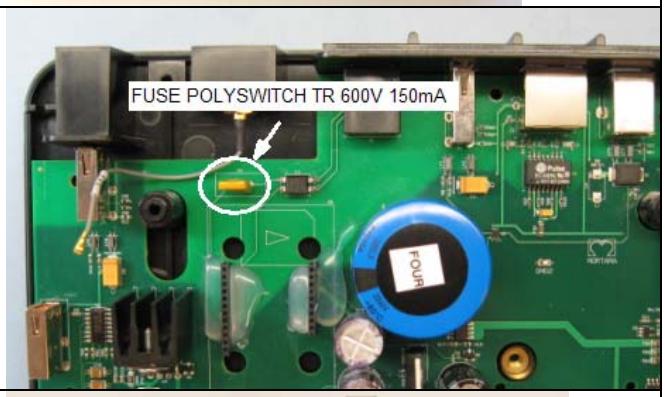
(The item ID table below is sorted by part #)

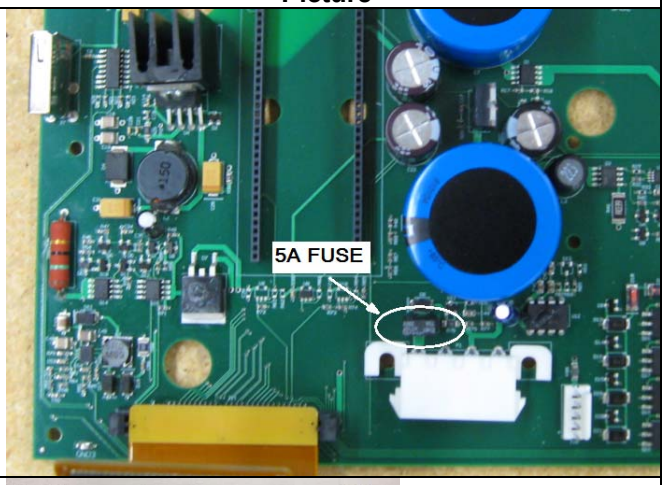
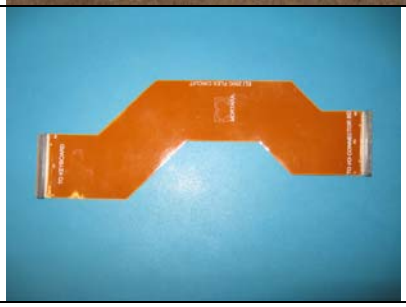
ELI 150c/250c Item Identification Table		
Item #	**Part #**	**Picture**
1	22500-150-51	**(Label not included)**
101	22500-250-50	 **(Label not included)**
2	25018-034-50	
3	25020-060-50	
4	25020-067-50	
5	25020-076-50	
6	26025-045-151	

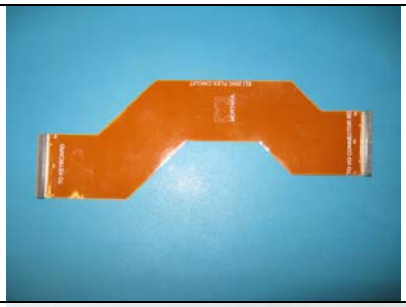
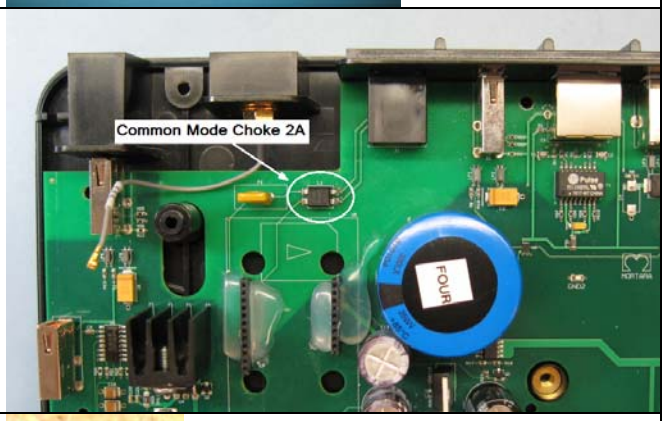
ELI 150c/250c Item Identification Table		
Item #	**Part #**	**Picture**
7	26025-073-50	
8	26025-074-50	
9	26025-077-170	
	9910-023-03 (radio only)	
10	26025-102-150	

ELI 150c/250c Item Identification Table		
Item #	**Part #**	**Picture**
107	26025-108-150	
11	26025-110-150	
12	3171-009	
13	3171-010	

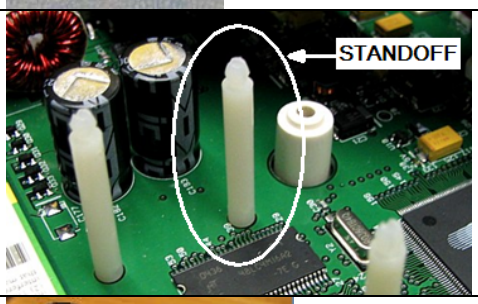
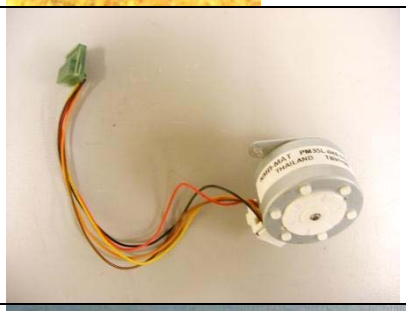
ELI 150c/250c Item Identification Table		
Item #	**Part #**	**Picture**
14	3225-003	
15	3225-008	
16	3375-004	
17	3375-006	

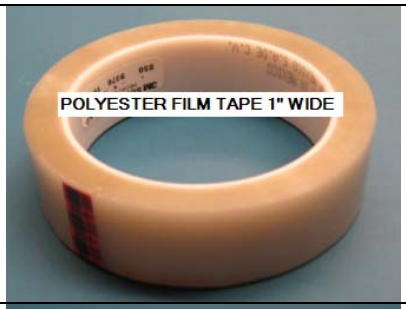
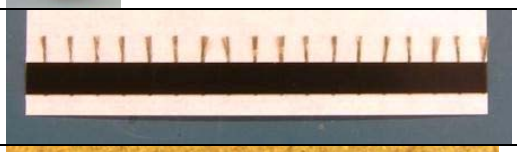
ELI 150c/250c Item Identification Table		
Item #	**Part #**	**Picture**
18	3600-008	
19	3600-009	
20	3600-016	
21	4027-001	
22	4027-002	

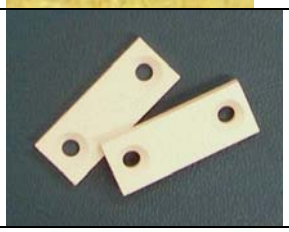
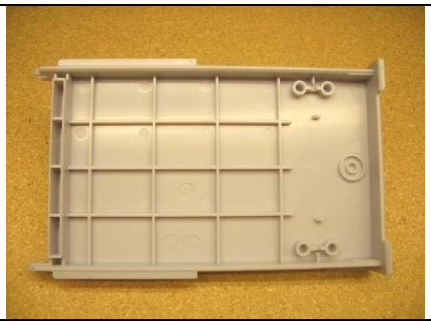
ELI 150c/250c Item Identification Table		
Item #	**Part #**	**Picture**
23	4027-003	
24	4800-006	
25	5400-019	
108	5450-004	
26	5450-005	
27	5525-110-02	

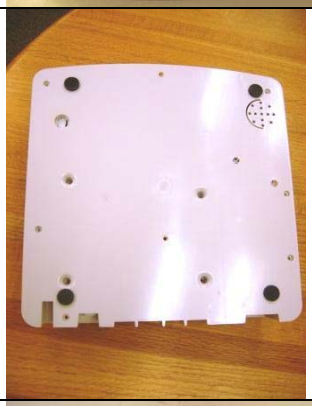
ELI 150c/250c Item Identification Table		
Item #	**Part #**	**Picture**
109	5525-111-01	
28	600-0515	
29	6001-002-01	
30	6020-060	
31	6020-061	
32	6020-062	
33	6020-430-02	

ELI 150c/250c Item Identification Table		
Item #	**Part #**	**Picture**
34	6020-735-02	
35	6020-835	
36	6020-835-02	
37	6030-025	
38	6100-004	
39	6125-004	
40	6125-017	
41	6140-003	

ELI 150c/250c Item Identification Table		
Item #	**Part #**	**Picture**
42	6141-003	
43	6160-003	
44	6320-003	
45	6520-003	
46	6545-007-01	
47	6570-420-01	

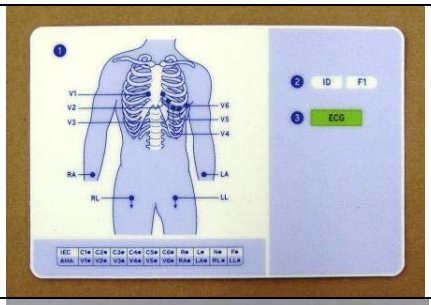
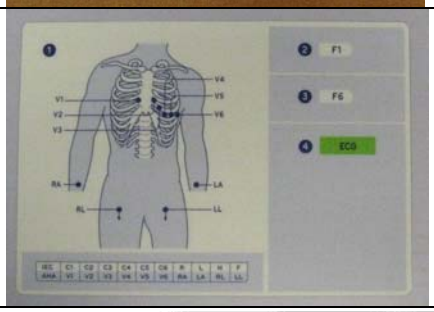
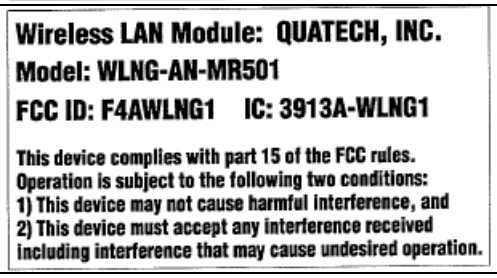
ELI 150c/250c Item Identification Table		
Item #	**Part #**	**Picture**
48	7400-019	
49	7401-003	
50	7403-001	
51	7480-090	
52	7495-001	
58	8342-004-50	
59	8342-008-02	

ELI 150c/250c Item Identification Table		
Item #	**Part #**	**Picture**
60	8342-009-01	
61	8342-018-01	
62	8342-019-01	
63	8342-020-01	
64	8347-004-51	
65	8347-005-51	
66	8347-006-51	

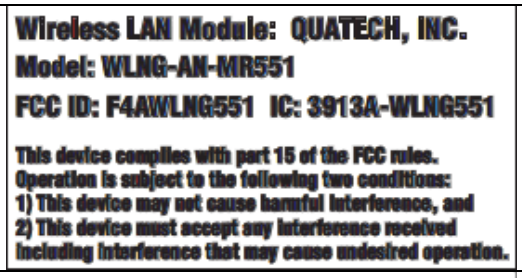
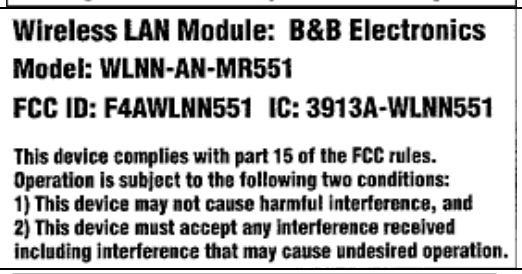
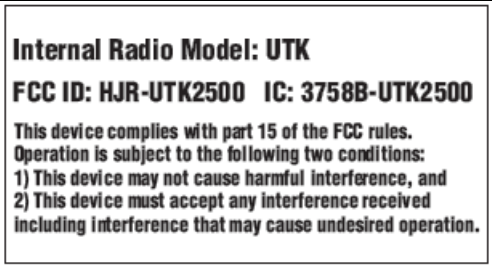
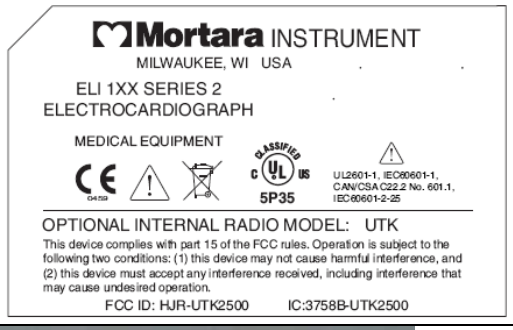
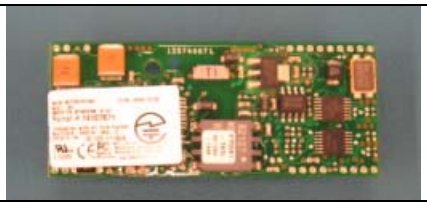
ELI 150c/250c Item Identification Table		
Item #	**Part #**	**Picture**
67	8347-007-51	
68	8347-009-50	
69	8359-001-50	
70	8359-002-50	
71	8359-003-50	

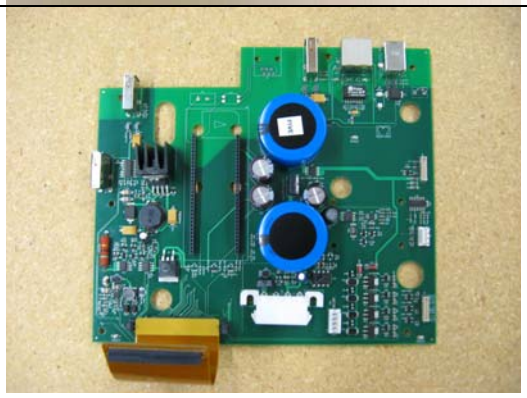
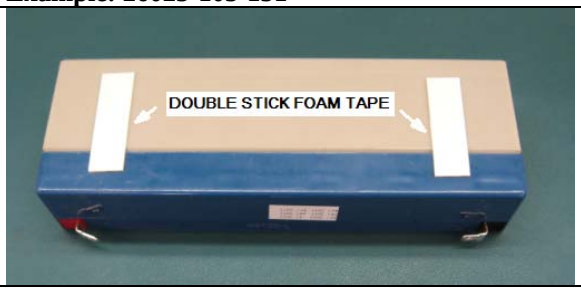
ELI 150c/250c Item Identification Table		
Item #	**Part #**	**Picture**
72	8359-004-51	
119	8360-001-50	
120	8360-002-50	
121	8360-003-50	

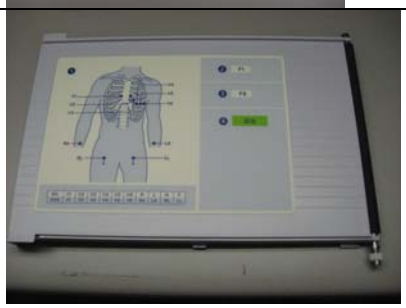
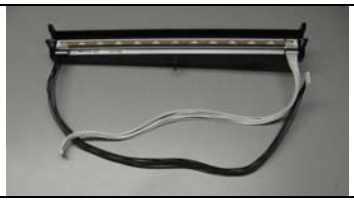
ELI 150c/250c Item Identification Table

Item #	Part #	Picture
73	9025-049-02	
74	9042-073-01 (ELI) 9042-073-02 (BUR)	
122	9042-074-01 (ELI) 9042-074-02 (BUR)	
75	9050-059-05	
76	9050-059-06	

ELI 150c/250c Item Identification Table

Item #	Part #	Picture
76	9050-059-09	
76	9050-059-10	
77	9050-059-07	
78	9050-086-01	
79	9910-017	

ELI 150c/250c Item Identification Table		
Item #	**Part #**	**Picture**
80	9910-022	
81	26025-099-151	
82	26025-105-151 (w/o COMM) 26025-105-152 (w/MODEM) 26025-105-153 (w/GSM) 26025-105-154 (w/LAN+WLAN)	 **Example: 26025-105-151**
83	SERV-ASSY-177-01	

ELI 150c/250c Item Identification Table		
Item #	**Part #**	**Picture**
84	SERV-ASSY-177-02	(Label not included)
85	41000-028-53	
125	SERV-ASSY-178-02	 (Label not included)
126	41000-028-52	

DEVICE SPECIFICATIONS

ELI 150c Specifications

Feature	Specifications
Instrument Type	12-lead electrocardiograph
Input Channels	Simultaneous acquisition of all 12 leads
Standard Leads Acquired	I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6
Waveform Display	Backlit, ¼ VGA color LCD (320 x 240); 3, 4+4, or 6+6 lead presentation
Input Impedance Input Dynamic Range Electrode Offset Tolerance Common Mode Rejection	Meets or exceeds requirements of ANSI/AAMI EC11
Patient Leakage Current Chassis Leakage Current	Meets or exceeds requirements of ANSI/AAMI ES1
Digital Sampling Rate	40,000 s/sec/channel used for pacemaker spike detection; 1000 s/sec/channel used for recording and analysis
Special Functions	Optional Mortara VERITAS resting ECG interpretation with age and gender specific algorithm; connectivity options for bidirectional communication
Paper Type	Perforated double Z-fold thermal paper; 108 mm (4”) wide, 200 sheets
Thermal Printer	Computer-controlled dot array; 8 dots/mm
Thermal Printer Speeds	5, 10, 25, or 50 mm/s
Gain Settings	5, 10, or 20 mm/mV
Report Print Formats	Standard or Cabrera; 3, 3+1, 3+3, or 6 channel
Rhythm Print Formats	3 or 6 channel with configurable lead groups
Keyboard Type	Elastomeric keyboard with complete alphanumeric keys, soft-key menu, and dedicated function keys
Frequency Response	0.05 to 300 Hz
Filters	High-performance baseline filter; AC interference filter 50/60 Hz; low-pass filters 40 Hz, 150 Hz, or 300 Hz
A/D Conversion	20 bits (1.17 microvolt LSB)
Device Classification	Class I, Type CF defibrillation-proof applied parts
ECG Storage	Internal storage up to 100 ECGs; optional expanded up to 200 ECGs
Weight	7.2 lbs. (3.3 kg) including battery (without paper)
Dimensions	11.25 x 11.5 x 3.75” (29.2 x 30.5 x 10.2 cm)
Power Requirements	Universal AC power supply (100-240 VAC at 50/60 Hz) 110 VA; internal rechargeable battery

ELI 250c Specifications

Feature	Specifications
Instrument Type	12-lead electrocardiograph
Input Channels	Simultaneous acquisition of all 12 leads
Standard Leads Acquired	I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6
Waveform Display	Backlit, ¼ VGA color LCD (320 x 240); 3, 4+4, or 6+6 lead presentation
Input Impedance Input Dynamic Range Electrode Offset Tolerance Common Mode Rejection	Meets or exceeds requirements of ANSI/AAMI EC11
Patient Leakage Current Chassis Leakage Current	Meets or exceeds requirements of ANSI/AAMI ES1
Digital Sampling Rate	40,000 s/sec/channel used for pacemaker spike detection; 1000 s/sec/channel used for recording and analysis
Special Functions	Optional Mortara VERITAS resting ECG interpretation with age and gender specific algorithm; connectivity options for bidirectional communication
Paper Type	Perforated Z-fold thermal paper; A4 or 8.5 x 11” wide, 250 sheets
Thermal Printer	Computer-controlled dot array; 8 dots/mm
Thermal Printer Speeds	5, 10, 25, or 50 mm/s
Gain Settings	5, 10, or 20 mm/mV
Report Print Formats	Standard or Cabrera; 3+1, 3+3, 6, 6+6, or 12 channel
Rhythm Print Formats	3, 6, or 12 channel with configurable lead groups
Keyboard Type	Elastomeric keyboard with complete alphanumeric keys, soft-key menu, and dedicated function keys
Frequency Response	0.05 to 300 Hz
Filters	High-performance baseline filter; AC interference filter 50/60 Hz; low-pass filters 40 Hz, 150 Hz, or 300 Hz
A/D Conversion	20 bits (1.17 microvolt LSB)
Device Classification	Class I, Type CF defibrillation-proof applied parts
ECG Storage	Internal storage up to 100 ECGs; optional expanded up to 200 ECGs
Weight	11.25 lbs. (5.1 kg) including battery (without paper)
Dimensions	15.5 x 17 x 4” (39.4 x 43.2 x 10.2 cm)
Power Requirements	Universal AC power supply (100-240 VAC at 50/60 Hz) 110 VA; internal rechargeable battery

TROUBLESHOOTING

System Troubleshooting Chart

LCD Message	Problem	Correction
BATTERY LOW – CHARGE UNIT	Unable to acquire ECG or unable to print.	Charge the battery with AC power.
LEAD FAULT, NO ECG CAPTURE	Lead fail or noisy ECG data.	Correct faulty lead or noise.
NO ANSWER	Unable to transmit ECG.	Check for correct phone number. Ensure modem and E-SCRIBE are online.
Date/Time will not Save	Defective Battery/Blown Fuse	Test Fuse and Battery, correct defect.

ECG Troubleshooting Chart

Affected Leads	Problem	Correction
LEADS OFF OR ONE OR MORE OF THE FOLLOWING: RA, LA, LL, V1, V2, V3, V4, V5, V6	Lead fail.	Indication of RL/RA/LA/LL/V1/V2/V3/V4/V5/V6. Check limb leads. Correct faulty lead(s).
Lead I	Missing/Noisy RA/LA.	Check patient prep; re-prep if necessary with new electrode.
Lead II	Missing/Noisy RA/LL.	Check patient prep; re-prep if necessary with new electrode.
Lead III	Missing/Noisy LA/LL.	Check patient prep; re-prep if necessary with new electrode.
All	High Freq. Noise.	Notch down filter from 300 Hz to 150 Hz; check proximity to power cables.

Transmission Troubleshooting Chart

LCD Message	Problem	Correction
TRANSMIT FAILED	Unable to transmit ECG.	Check phone line. Ensure site number is valid. Try again.
ERROR-DICOM Not Enabled	A DICOM communication was attempted, but the unit is not configured for DICOM.	Configure the system to DICOM and reboot.
UNABLE TO SAVE ECG	No available memory. ECG data too noisy to store.	Press stop to continue. Transmit or mark records for deletion in the directory. Correct noise and try acquisition/storage again.
DHCP FAILURE	The WLAN module failed to get an address from DHCP.	Contact Mortara Technical Service.
DPAC FAILURE	WLAN failed to initialize.	Contact Mortara Technical Service.
CAN'T CONNECT TO ACCESS POINT	A link to the access point could not be established.	Ensure the IP address is correct. If problem persists, contact Mortara Technical Service.
CAN'T CONNECT TO REMOTE LINK	A link to the access point was established, but the link to the destination failed.	Ensure the IP address is correct. If problem persists, contact Mortara Technical Service.

Transmission Troubleshooting Chart (continued)

LCD Message	Problem	Correction
UNABLE TO SAVE ORDER	Order storage failed.	Attempt to retransmit orders.
UNABLE TO SAVE WORK ITEM	DICOM order storage failed.	Directory full; mark records for deletion or delete records.
INCORRECT RESPONSE	Connection established, then failed.	Connection started but failed; attempt to reconnect.
NO CUSTOM ID	Received orders failed.	Previous Custom ID not compatible with current Custom ID, or no Custom ID.
PAPER QUEUE FAULT	Unable to print. Paper queue mark not detected as expected.	Add paper; manually advance page evenly past closure point of writer and close writer cover and press STOP.
CONNECTION FAILED	Unable to transmit or receive ECGs.	Check for correct baud rate, phone number, and cable connections or site number.
None	File not successfully transmitted via LAN.	Check share permissions on host device.
None	Unable to connect with LAN with crossover cable.	Implement hub vs. crossover cable.

Conformance Testing

Conformance testing is to be performed by Authorized Mortara Service Representatives to verify the device is functioning correctly after repair operations have been performed. Testing results should be documented on the test data record at the end of this section of the manual.

Power Testing

- Ensure battery is fully charged before performing these tests, voltage and current limits are based on a fully charged battery.
- Ensure there is no power connected to the UUT AC inlet.
- Remove upper housing and writer assembly. Disconnect battery by pulling battery cable off of the red terminal.

  NOTE: *Based upon customer usage and age of battery, replace as needed.*

- **Note battery age** (if possible)

  This information can be found on the white "date code" sticker located on the battery (use the earliest date that is not crossed out).

- **Battery (open circuit)**

  Measure battery voltage using a voltage meter; verify the meter reads greater than 12.5vdc.

- **Battery (load)**

  Measure the battery voltage using a volt meter and a power resistor load (10ohm, 20watt) in parallel with the battery. After approximately 5 seconds, verify the meter reads greater than 11.7vdc.

- **Off current**

  Connect a current meter in line with battery. With the UUT power off, verify the current meter reads less than 100 uA.

- **On current**

  Turn on the unit and verify the current meter reads less than 250 mA.

- **AC charging current**

  Apply AC power to the unit and verify that the current draw from the battery reverses polarity and the value starts decreasing as time increases.

- **Battery charger output voltage**

  Disconnect the current meter and measure the battery charger output voltage between the red disconnected battery cable and the negative terminal on the battery. It should read between 13.0vdc and 14.0vdc.

- **Verify all power cables are reconnected properly, and reassemble unit.**

Functional Testing

- **AC LED/Display**

  Connect AC power cord to the unit and verify that the green AC LED (located to the left of the display) illuminates continuous.

  ***NOTE:** The battery indicator will be clear when charging and will illuminate white when fully charged.*

  Turn the unit on and verify the text on display is clear and legible and there are no flickering or missing lines/pixels.

- **Adjusting the Writer Cue Sensor**

  NOTE: This test should be performed with the AC power turned on.

  1) Install paper into the unit with the cue mark approx. 1 – 2 inches away from the tear bar. Make sure that the cue sensor is seeing white and not any markings on the paper.
  2) Use a DMM to measure the DC voltage at test point (TP2/QSNS) on the keyboard with respect to ground (GND1). Adjust R323 on the keyboard to between 1.95 V-DC and 2.05 V-DC at test point P15. Set this as close to 2.0 V-DC as possible.
  3) Perform either the Writer test or print a test ECG. The paper should cue to the next sheet of paper, print and then advance to the beginning of the next sheet of paper.
  4) If the Writer test is performed the results should be compared with the test printout in this manual.

- **Writer**

  Open and close the writer door to verify smooth operation. Verify that the door unlatches without sticking and that it latches completely. From the main screen, simultaneously press shift+alt+RHY. Verify that a test page is printed and the writer stops on the cue mark. The perforation of the paper should line up with the tear edge on the writer. Assure there are no gaps in the printing and the print darkness is uniform across the entire page. Verify the writer gears do not skip and paper is tracking properly (you may need to print multiple pages to observe this).

- **ECG & Keyboard Matrix**

  Connect an ECG simulator to the AM12 or WAM patient interface. Set the simulator to a known heart rate and amplitude; preferably to a setting that you have a "known good" printout for comparison. Press the ECG key to capture an ECG. Verify there is an audible beep with each key press. Enter Last name "PARCFL8" (Note: "PARCFL8" ensures the keyboard matrix is fully tested), then press F6 (Done). Verify that 12 ECG traces print correctly and assess the printout quality. Ensure uniform darkness across entire printout.

- **ECG Noise Test**

  Connect a Shorting Block (TF-0063) and adapter or equivalent to the AM12 or WAM patient interface. Set the ECG gain on the unit to 20mm/mV. Print a rhythm strip (approx. 1 page). Verify that no channels have more than 0.5mm of noise.

- **Lead Failure Test**

  Connect a patient cable to the patient input of the unit, with the other end connected to a lead failure box (TF-0620). Using the lead fail box, momentarily press each push button to open the patient leads one at a time and verify the display indicates an open lead condition for the corresponding lead.

- **Communication options**

  Verify successful transmission of all applicable communication options by transmitting the ECG record stored earlier to a compatible receiving device.

  - Modem
  - LAN
  - WLAN
  - GSM/GPRS
  - USB

Device Cleaning

Clean unit per the instructions provided in the Maintenance & Cleaning section of the service manual.

Safety Testing

The following safety tests should be performed in accordance with all local regulatory requirements:

- Earth Leakage
- Enclosure Leakage
- Patient Leakage
- Patient Auxiliary Current

ELI 150C/250C Test Data Record

Unit Serial #: _____

- □ Power Testing
  - □ Note Battery Age (If not possible enter N/A) _____/_____ (week/year)
  - □ Battery (Open Circuit) Voltage _____ VDC
  - □ Battery (with Load) Voltage _____ VDC
  - □ Off Current _____ uA
  - □ On Current _____ A
  - □ Battery Charger Output Voltage _____ VDC

  * Based upon customer usage and age of main battery, replace as needed.

- □ Verify all power cables are properly reconnected and reassemble unit

- □ Functional testing
  - □ AC LED/Display Functionality
  - □ Cue Sensor Calibration
  - □ Writer Test
  - □ ECG & Keyboard Matrix Testing
  - □ ECG Noise Test
  - □ Lead Failure Test

  Communication Option(s)
  - □ Modem
  - □ LAN
  - □ WLAN
  - □ GSM/GPRS
  - □ USB

- □ Device Cleaning

- □ Safety Testing PASS / FAIL (circle)
  - □ Earth Leakage
  - □ Enclosure Leakage
  - □ Patient Leakage
  - □ Patient Auxiliary Current

Performed by: _____ Date: _____/_____/_____

Communication Options

The following Communications Options are available on the ELI150c/ELI250c:

LAN
WLAN
Modem
GSM/GPRS Mobile transmission (ELI150c Only)
Transmission to USB Thumb-drive
USB Mount to Windows PC (USB Device option)

Sync Media (in Settings menu):

The Sync Media can be set to the following:

LAN + WLAN / WLAN + LAN
LAN + GSM / GSM + LAN
LAN + GPRS / GPRS + LAN

Sync Media will attempt a connection of the preferred method first, and if it fails or times out, will attempt the secondary mode of communication.

Communication Error Messages

DPAC Failure

This error message occurs if the DPAC fails initialization. This likely indicates a hardware problem preventing communication with the Module or a hardware problem with the Module itself.

Can't Connect To Access Point

This error message occurs if the module cannot associate with an access point. This likely indicates one of the following things: the Module's SSID is incorrect, no network with that SSID is available, the wrong security method is chosen, or the AP's configuration is incompatible with the Module.

DHCP Failure

This error message occurs if the Module failed to acquire an IP address via DHCP.

Can't Connect To Remote Link

This error message occurs if the module is able to communicate with the access point, but unable to establish a route through the network to communicate with the Remote Host. This error message may indicate the Remote Host is not ready to receive data. If the Remote Host appears to be ready, this message may indicate invalid entry of one of the following network parameters: IP address, Def. Gateway, Sub Net Mask, Host IP, or Port Number. It may also indicate that the correct security method was chosen but one or more of its required parameters were set incorrectly.

> ***NOTE**: It is possible that the Module can still transmit data with an incorrect gateway or subnet mask depending on the path through the network the data is being transmitted.*

Communication Options (Software only)

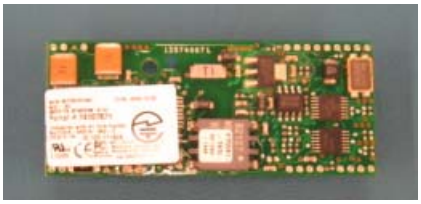
- LAN
- USB (USB Device option)

Communication Options (Hardware + Software)

WLAN

GSM (150c Only)

Modem



Shortcuts

Configure Transmit Media

F6 (More)
Shift/Alt/X
Enter ‘admin’ password, Press Enter key

Directory Dump (To dump entire directory to USB thumb drive)

F6 (More)
F1/#1 (Directory of Stored ECG’s)
Shift/Alt/D